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tuner, model ST-510



Marantz stereo cassette
deck, model SD-5010

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ELECTRONICS

AUSTRALIA

Volume 43, No. 5
May, 1981

AUSTRALIA'S HIGHEST SELLING ELECTRONICS MAGAZINE

Infrared remote control



Our new infrared remote control has two independent channels and a range of 20 metres, yet will cost you only about \$65. Details on p50.

NOVA-80

Due to circumstances beyond our control, presentation of the Nova-80 computer project has been delayed. We apologise to readers for any inconvenience that this delay may cause.

On the cover

Are you good at crossword puzzles? If you are, you could win either a magnificent Marantz SD5010 cassette deck or the high-performance ST510 AM/FM tuner. The details are on p43. For a full review of the SD5010 cassette deck, turn to p46.

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Editorial Viewpoint

A TV resolution problem

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Although conducted with due decorum, a recent symposium in Sydney, arranged by the Federation of Australian Commercial Television Stations, lifted the lid off a large can of worms. It had to do with TV channel planning and use in Australia.

In 1956, Australia started off with 10 VHF channels, subsequently increased to 13, at the expense of the FM band. We are now trying to recover the FM band at the expense of VHF TV channels, and seeking to compensate by allocating some TV services to UHF.

Unfortunately, existing or new stations are unwilling to accept a UHF channel, if it means that they have to compete directly with other stations on VHF. In terms of coverage, a UHF service is more expensive to establish and operate, while the accessible audience is smaller.

Not surprisingly, strong pressure was evident at the FACTS symposium to devise some way of juggling the present VHF band plan to preserve at least 12 active VHF channels. Several options were put forward, all with implications for other services, and all with technical implications in respect to both transmitters and receivers. At this stage, there appear to be no soft options.

In large degree, the present problems stem from changing attitudes to the FM band, but it is an over-simplification to suggest that Australia should have been content to follow international practice from the outset. A background paper before the symposium nominated no less than 10 substantive VHF band plans, plus four variations therefrom, as used in Japan, Indonesia, New Zealand and Australia!

UHF channel planning is also in a state of flux (confusion?) despite the fact that an increased number of services are coming into operation. With its 7MHz-wide channels, Australia has the opportunity to accommodate more services on UHF than with European-style 8MHz channels but an anomaly would be created if we tried to comply (nominally) with the European 28-63 numbering system.

Delegates concerned with receivers pointed out that they faced problems of past, present and future. For many receivers in current use, substitute tuner biscuits and/or add-on UHF facilities would simply not be available. In more modern receivers, and VCRs, varicap tuners intended to cope with VHF channel 5A, may not cope with any extension beyond channel 11.

But they also pointed out that synthesiser tuners are in the pipeline. These are precise and reliable but they are based on the assumption that user-countries will have a band plan which falls within the limits of international practice and is free of anomalies — like adjacent UHF channels which have the same numbers!

The FACTS symposium may have been looking forward over 20 years but the industry needs the blueprint of band usage immediately, if not sooner!

Neville Williams

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News Highlights

Modern weapons too complex says US Defence Department

The United States government is taking a serious look at the place of advanced technology in weapons. Concern has been expressed that new highly sophisticated weapons are too complex for military personnel to use and maintain.

Two reports, one by the Defence Department and one by the General Accounting Office, which looks over expenditure by government departments, have concluded that electronic weapons systems in particular have become overly complex, with too little regard given to the level of skill of the troops who must eventually use them. The incorporation of unproven innovations in new systems has also been criticised, along with procurement procedures.

The GAO's report calls for greater consideration of quality control and logistics support in the design of new weapons. It

also calls for greater consideration of human issues — which in this context means combat stress and fatigue as well as low skill on the part of the weapon's users. Using complex untested technology in weapons systems generates more problems than it overcomes, the report says.

Complex technology also leads to high cost and long production delays in weapons development. Research programs frequently do not consider the need for field maintenance of new weapons and the need for long training before the weapons can be used.

Excessive complexity of weapons systems is encouraged, says one report, by military project officers and their contractors who know that their chances of getting lucrative contracts improve when they can promise more "kills per dollar" — since this is an accepted measure of the capability of a system.

British Government backs robot technology

The British Robot Association recently held a press conference in London to announce the results of a study of robot usage in the UK. According to members of the Association, British industry management and labour are having great difficulty coming to terms with automation. Figures released by the Association show that Britain is behind the US, Sweden, Germany and Japan in the number of robots installed.

Tom Brock, the executive secretary of the BRA, is hopeful however. He believes that within a year the rate of growth in automation in the UK will be 40-50% per year.

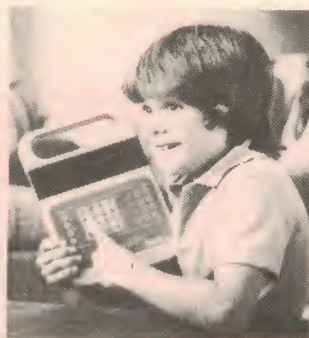
There is currently a major government-backed program under way in Britain to encourage the design and use of robotic assembly equipment. Department of Industry funding is running at £1.3 million a year, and could rise to £2.7 million shortly. One form of assistance offered by the DOI is an application support package in which 25% of the cost of a new process will be met.

A number of people at the BRA meeting tried to account for the reluctance of British industry to adopt robots. Perhaps surprisingly, the overall view was that trade unions were not to blame. Rather the reluctance is in the board room. "British directors will change their cars — every year, but not their production machinery" said one of the participants at the conference.

First public broadcast of 3D television

According to a recent report in Radio Electronics, the world's first public transmission of 3D television is claimed by 3D Television Systems of North Hollywood, CA. Subscribers to the SelecTV television-cable system saw 3D films for the first time on December 19, 1980.

Viewers of SelecTV were able to see the 3D pictures by wearing special glasses similar to those used for 3D movies. The system is described as "being able to portray objects coming out of the screen to within several inches of the viewers' eyes and then going deep back into the TV screen".



Talking electronic learning aids

NEW FROM Texas Instruments are two electronic learning aids employing speech synthesis technology. The new aids are called "Speak & Read" and "Speak & Math", and are similar in concept to TI's earlier "Speak & Spell" machine.

TALKING TEST GEAR FOR THE BLIND!



A British company has brought together speech synthesis and electronic testing equipment to allow blind people to fill a wide range of jobs in the electronics industry.

The device, the "Matchless Digital Speakout", converts the digital reading from a test instrument into synthesised speech. As the measuring probe is applied to the part, measurement details are transmitted to a display unit and then to the Speakout which converts them into words. The standard vocabulary consists of numbers, mathematical symbols and

units of measurement. The unit weighs less than a kilogram, and can be used either with batteries or from the mains.

Although developed primarily for blind people on behalf of Britain's Manpower Services Commission, the system can be used in conjunction with any device that transmits measurement information in binary code. It can be used, for example, as a readout (speakout?) device in avionics equipment to free the pilot from the need to constantly monitor visual displays.

Japanese to market electric vehicles

British manufacturers of electric vehicles are concerned at the recent announcement that the Japanese will be offering electric vehicles on the UK market for around £5000 — half the price of comparable British vehicles. Although the British claim a two-year technical lead, members of the Electric Vehicle Association of Great Britain say that they are unable to match the Japanese prices.

Japan started its electric vehicle program in 1971. Four companies — Mitsubishi, Suzuki, Mazda and Daihatsu — began the development of prototype

vehicles under the direction of the Government's Ministry of International Trade and Industry. In 1978, the Japanese government set up the Electric Vehicle Engineering Research Association to concentrate on the development of a mass produced car which would be commercially viable in both home and overseas markets.

Daihatsu is the only one of the four manufacturers now marketing a commercial vehicle. It claims to have sold more than 4000 units, of which one quarter are used on the road.

Encyclopedia on one disc?

Doctors Alan E. Bell and Robert A. Barolini of RCA Laboratories, US, have received a US patent for a recording method that makes it possible to put 100 billion (that's billion, not million) bits of information of two sides of a single disc.

Data is recorded with an intense beam from a semiconductor laser, which burns a series of microscopic holes in a thin layer of tellurium deposited on a plastic disc. The information is read out by a less intense beam from the same laser which shines through the holes and is reflected by a layer of aluminium beneath the tellurium.

The high density data storage system has many potential applications. A multi-

volume encyclopedia could be stored on two sides of one disc. It may also be possible to store X-ray images which at the moment use expensive silver based film. Possible applications include word processing, still and motion pictures and business and government data storage.

— Radio Electronics

New Dick Smith ranch

Dick Smith Electronics has opened new stores in Sydney and in Perth. The Sydney store is located at 145 Parramatta Rd, Auburn (Telephone 648 0558) and trades seven days a week. The address of the new Perth store is Cnr Wharf St and Albany Hwy, Cannington (Telephone 451 8666).

Versatile colour dashboard display

Zenith Radio Corp of the United States has developed a car dashboard display based on a cathode ray tube which allows the display of information in formats that would be impossible using conventional systems. The CRT display is designed to be used in conjunction with microprocessor controlled car electrical systems and transducers, and is able to display parameters such as speed, fuel level, temperature and oil pressure in alphanumeric and graphic form.

Main advantage of the new system is its flexibility. The styling of the display can be changed easily without retooling, and languages other than English can be easily displayed. Only the programming of the unit need be changed to create new display formats and contents, regardless of their complexity.

Zenith expects the new display unit to be available for installation in cars of the mid-1980s. With the market for automotive display systems predicted to reach \$493 million in 1984, the proponents of many competing display systems are beginning a fiercely contested race to attract the attention of the world's vehicle manufacturers.

Go-ahead for British wind energy project

A giant windmill, 50m tall and with a 60m diameter blade, will be built in the Orkney Islands off the northern tip of Scotland to provide electricity for the 1000 people living there. Energy Minister Mr David Howell says the project is an important step in the development of wind power and will give first hand experience in the construction and operation of wind driven generators.

The 3MW generator will be built by a group that includes British Aerospace and GEC. It will consist of a two bladed horizontal axis turbine mounted atop a 46m high hollow concrete tower. A smaller 20m wind generator of 250kW will be built on the same site, and is due to come into service next October as a test bed for the larger machine.

The UK government is providing \$9.2 million of the large generator's \$11.2 million cost and a quarter of the \$2 million needed for the smaller machine. The government hopes that the project will lead to the commercial manufacture of wind generators of the 250kW size.



If you're about to buy another printer... don't. Read the small print first.

The Epson MX-80. It's not just last year's model updated. It's a top-of-the-line printer. It's new. From the ground up. And it's the most revolutionary printer to hit the market since Epson invented small printers for the 1964 Olympics in Tokyo. Don't take our word for it, though. Compare. There simply isn't a better value in a printer.

But here's the fact that's going to stand the printer world on its ear. The MX-80 sports the world's first *disposable* print head. After it's printed about 60 million characters, you can throw it away. Because a new one costs less than \$50, and the only tool you need to change it is attached to the end of your arm.

Now that's revolutionary, but that's only the beginning. The MX-80 also prints bidirectionally at 80 CPS with a logical seeking function to minimise print head travel time and maximise throughput. It prints 96 ASCII, 64 graphic and eight international

characters in a tacksharp 9 x 9 matrix. And it provides a user-defined choice of 40, 80, 66 or 132 columns and multiple type fonts.

The MX-80 is the first of a revolutionary series of Epson MX Printers. These employ the most advanced automatic assembly and machining techniques in existence to produce a printer that is incredibly versatile, remarkably reliable and extraordinarily inexpensive. It's a printer that could only come from the world's largest manufacturer of print mechanisms: Epson.

If it sounds like we're proud of the MX-80, we are. Not only does it do things some of the world's most expensive printers can't do, it'll do them for you for much less. And if that isn't revolutionary, we don't know what is.

For further information, don't hesitate to contact your nearest Warburton Franki office.



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NEWS HIGHLIGHTS

Teletext adapter from Radofin

Several television channels in the Seven network have been transmitting Teletext program material for some time now, but many people are not aware that they can receive this information on their current TV set by fitting a readily available adapter.

Radofin Electronics, a Sydney-based company, recently released a compact teletext decoder (the Adam 180) which can be used with any black and white or colour television receiver. The adapter is an add-on unit fitted between the outside antenna lead and the TV set. Tuning is simple, and installation is said to take only a few minutes. It is essential however that an outside antenna be used, as an indoor antenna will not allow satisfactory reception of the Teletext signals.

Teletext is transmitted during normal program times by ATN-7 Sydney, HSV-7 Melbourne, BTQ-7 Brisbane, NBN-3



Newcastle and TVW-7 Perth. Information currently available includes news, police news, weather warnings and forecasts, traffic reports, sports and TAB results, share and commodity prices, food prices, theatre and travel guides and a children's page.

The Adam 180 teletext adapter comes complete with remote control and sells for \$575. Further information from Radofin Electronics (Aust), 5 Curlew St, Bondi, NSW 2026.

ABC to trial French teletext system

The Australian Broadcasting Commission will start field trials soon of the French teletext system "Antiope".

In the meantime, several commercial television stations have been testing the British teletext system, with mixed results. The British system was originally designed for use with UHF TV channels, and according to the ABC may not be appropriate for the Commission, which largely uses low-numbered VHF channels.

Tests of the British system by the ABC have shown that the data may be easily distorted during transmission on VHF frequencies so that errors and omissions can occur. Antiope is fundamentally different from the UK system. Rows of

characters may be transmitted without the need to synchronise them with the TV line structure as required by Teletext. The French system also allows reduction in the speed of transmission to minimise the number of errors in the text.

Where it is vital that the data be transmitted accurately, Antiope can be adapted to eliminate virtually all errors by the use of special data encoding systems.

If the ABC's field trials are successful it will recommend that the Antiope system be considered by the Department of Communications for adoption in Australia — a move which would be strongly opposed by some commercial stations.

Video equipment — big \$\$\$ by 1985

By 1985, the annual sales value of consumer video equipment, excluding TV receivers and video games, will have reached \$2.4 billion in the US and \$3 billion in Europe, according to a new report from Mackintosh Publications Ltd of Britain.

The Mackintosh report, entitled "VCRs, Cameras and Blank Tapes" predicts that the most important product in Europe will be the video cassette recorder, with around 40% of the market. Video cassette tapes and cameras will account for a further 25% of the market each, with the remaining 10% going to videodisc players and large screen television projectors.

Meanwhile the timetable for worldwide introduction of the VHD video disc system has been announced by Mr Gary Dartnall, president of VHD Programs Inc and VHD Disc manufacturing Co. Both companies are joint ventures by General Electric Co, Victor Co of Japan, Matsushita Electric Industrial Co and Thorn-EMI of the UK.

The VHD — Video High Density — disc system will be introduced in Japan in October by JVC and Matsushita, with an opening library of 100 film titles. US sales of the VHD system will begin in January 1982.

Negotiations for first run movies, shows and other entertainment and educational material are currently in progress with major studios.

Micros invade the jet engine

A new range of advanced fuel control systems, designed by Dowty and Smiths Industries Controls Ltd of Britain, will literally take off this year when a Harrier jump-jet fighter becomes the world's first military aircraft to fly with a microprocessor based fuel injection system.

The Fuel Authority Digital Electronic Control system (FADEC) will also be flight tested aboard a Westland Lynx helicopter and on one or more British Airways aircraft.

"Fuel Authority" control means that after the pilot selects the amount of power he requires from the aircraft's engines the complete operation is taken over by the microprocessor. Hydromechanical control of engine speed is eliminated, saving considerable weight and space aboard the aircraft. The increased accuracy of the computer system also prevents over-running of the engine which leads to a reduction in engine life.

FADEC is expected to be fitted to later versions of the European Tornado combat aircraft, and will also be available for commercial service in a range of civil aircraft from 1985.

Business Briefs:

- By 1984, Western suppliers of communications equipment may be doing more than \$250 million worth of business in China. By contrast there is likely to be little return on the significant investments which ITT and other companies have made in developing an export trade with the USSR, according to a report from International Resource Development Inc.

- Dick Smith Electronics Pty Ltd has announced that it will open a sales office in New Zealand shortly. Initially the branch will carry a selected range of Dick Smith products, including the System 80 computer.

- During March the A & R Soanar Electronics Group opened their Queensland branch and warehouse in Brisbane. The group now has branches in all mainland states of Australia. The new branch is located at 119 Abotsford Road, Mayne, 4006.

- Mr Barry J. Leather has been appointed Instrumentation Department Manager at the North Ryde Division of Amalgamated Wireless (Australasia) Ltd.



The Official Line

— from the Department of Communications

Background to the satellite system

Most readers of "Electronics Australia" would know that Australia is developing a National Communications Satellite System. Not very many would, however, be aware of just how far along the track we are in doing this, or what is involved in the process.

Tenders for the supply of the system close on May 4th and at this stage it is expected that the satellite system could be in operation by mid-1985.

Background

The Government first announced in October, 1979 that it had decided in principle to establish a National Communications Satellite System. This announcement followed Government consideration of reports from a working group of officials and from an earlier Task Force which both recommended the establishment of a communications satellite system in Australia.

The aim of the satellite is to provide television, radio and telephone services for people in remote areas of Australia and to other areas which do not receive these services adequately. As well as this, the satellite system would be able to distribute high speed data communications and improve other services, such as navigational communications.

After the October 1979 announcement, a Satellite Project Office was established within the Postal and Telecommunications Department — now the Department of Communications — to develop proposals for establishing the system. This worked closely with other bodies such as the Overseas Telecommunications Commission, (OTC) the Australian Broadcasting Commission (ABC), Telecom Australia and the Department of Transport.

At present, OTC is the authority designated to own and manage the system until final decisions on ownership arrangements are made.

The Department of Communications, largely through what has now become the Satellite Policy and Co-ordination Division, provides overall policy advice to the Government on the role of the satellite and on issues such as financial implications, Australian industry involvement and employment aspects.

The Government has announced that it is examining the possibility of operating the spacecraft part of the system through an arrangement whereby private enterprise could take up to 49% of the share capital of an operating company, with the Government holding 51%.

Expressions of interest in investing in

such a company were called for from private companies in November last year. At the time of writing (March) discussions are being held with all organisations which have indicated they are able to invest a minimum of \$1M. So as not to exclude small investors, arrangements are being considered whereby some 3-4% of the private enterprise equity in the satellite company could be set aside for small investors.

If it is decided to form such a company, it is understood that it be set up in time to participate in the evaluation of tenders for supply of the satellite system. The company would place the final contracts.

How the Satellite System will work

The system will be made up of a space segment and an earth segment. The **space segment** will be composed of the satellites and the associated ground control stations — tracking, telemetry, control and monitoring stations.

It is envisaged that initially there will be three satellites. Two of these will be in orbit, — one operational and one standby — and one will be a spare on the ground. There is also an option for a further satellite, if required.

It is planned to locate the satellites in geostationary orbit above the equator to the east of Australia and to operate in the 11/14GHz frequency band. Clearance for this has been sought from the relevant international body.

Each spacecraft will have 15 transponders, or in lay terms receiver/transmitter devices. Four of these will each have a 30W power output and the remainder will each have an output of 15W.

The 11 lower-powered transponders will carry nationwide services such as telephony and data communications, with one beam covering the whole of Australia. The four high-powered

transponders, however, will each be allocated to one of four smaller beams — one for Western Australia, one for South Australia/Northern Territory, one for Queensland and the other for NSW, Victoria and Tasmania.

The combined effect of higher power in the satellite and smaller coverage areas on the ground will enable ABC television and radio services to be received via small, inexpensive earth stations at homesteads and small communities in remote areas of Australia.

Bookings have now been made with NASA for launching of the Australian satellites by either the Space Shuttle or the Delta launcher. A further option under consideration is the European Space Agency's "Ariane" launcher.

The **earth segment** will comprise the wide range of earth stations transmitting and receiving the communications signals for television, radio telephone, data etc. Relatively large earth stations with antenna diameters from 8-11 metres will be located in each capital city. At the other extreme, smaller earth stations will be located in more remote regions and homesteads throughout Australia.

Isolated homes and communities receiving television and radio services via the satellite's high-powered transponders will generally own their own earth stations. Earth station ownership will also be open to private sector users of the satellite system.

Services via Satellite

In its first "generation" — the first seven years or so — the satellite system will provide a number of services for both public and private sectors, and these may be extended in later years.

At first the satellite system will provide ABC radio and television services to remote communities and other areas; as well as telephone services, aircraft safety control communications and a variety of data services including facsimile and computer data transfers. The system also has the capacity to distribute other forms of broadcasting, and decisions still have to be made on how this capacity should be used in terms of commercial, special interest, educational and other broadcasting interests.

A national communications satellite system will certainly have a profound impact on Australian communications services and will be an important step in the application of satellite technology to Australia's communication requirements.

R. B. Lansdown, Secretary,
Department of Communications.

IBM for home computer market?

Disco-Vision, the IBM-MCA joint venture and company formed to market video discs and players, could be IBM's entry into the consumer electronics market, according to a report by International Resource Development Inc, a market research company. If IBM is successful in videodisc marketing it may expand into the growing personal and home computer market.

STRING SYNTHESISER KIT BACK!

(*STRING ENSEMBLE)

Due to unprecedented demand we now have new stocks of this fantastic synthesiser.

This **complete kit** includes professional Italian made 49-note keyboard, all timber cabinetry, and **all** components needed — down to the last nut and bolt. It comes complete with a comprehensive 35-page instruction and assembly manual!

Anyone considering the purchase of a string synthesiser would be **mad** not to check this out.

This is the fabulous English designed unit capable of synthesising:

- String section of orchestra (i.e. a chorus)
- Single stringed instruments
- Brass, e.g. Trumpet sounds
- Woodwind, e.g. Clarinet
- Organ
- Piano Accordion
- Even a "Mighty Wurlitzer" effect!
- Plus several combinations of above!!

\$445⁰⁰

And the price for all this wizardry? just plus \$10.00 shipped anywhere in Australia.

SHOWBAG SELLOUT

What can we say but "Thanks"

As you know, last April we advertised our goodies for enthusiasts. Well, the demand was fantastic as well as the complimentary comments about our brand new store layout. If you have not visited as yet — why not do so soon?

Remember, we are open 7 days a week and we probably have a broader range of components and kits than your present supplier!

200W (RMS) FULL RANGE P.A. BIN!!

You asked for it — a **kit version** of those heavy-duty P.A. Bins! This professionally designed pre-tuned Bass-reflex enclosure contains a **massive 18"** — yes 18" — Celestion 200 watt main driver especially cone-stiffened for higher power Bass or general PA work. Also included are 2 x 100 watt Piezo horns. System crossover is around 2KHz.

Complete kit includes all pre-cut panels, 2 horns, 18" driver, cannon connector, etc.

Build this system yourself and save a fortune on built-up prices. Remember 200 watts **RMS** capability!!

ONLY

\$495⁰⁰

complete

+ \$20.00 sent anywhere in Australia.

E. A. Graphic Analyser Kit (E. A. March '81)
Complete kit of parts including transformer, modulator, Xtals, front panel, etc.\$89.00
Colour Option\$20.00
Horwood Box to suit\$14.50

E.T.I. 477 Mosfet Amp Module (E.T.I. Jan-March '81)

Complete kit including high voltage Hitachi Mosfets, fibreglass P.C.B., **pre wound** coil, etc.\$59.00
Cast front panel\$39.50
Power Transformer\$39.50
Other components for 5000 amp available.

"Le Gong" Kit (Refer E. A. March '81)\$13.95

"P. C. Birdies" Kit (Refer E. A. May '81) only\$14.95
Contains all parts, including Jiffy Box, I.C., P.C.B. etc.

2 Channel Infrared Remote Control Kit (Refer E. A. May '81) Complete kit of parts\$65.00

Sound Level Meter Kit (Refer E. A. May '81)
Complete kit of parts for this project including **high quality** electret mic. insert.\$39.50

P.C.B.'s for many other current projects available.

UHF Masthead Amp Kit (Refer E.T.I. April '81)
Complete kit of parts including fibreglass boards, OM350, power supply, etc.only \$35.00

P&P CHARGES:

| ORDER VALUE | CHARGES |
|---------------|---------|
| \$ 5 | \$9 99 |
| \$ 10 | \$24 99 |
| \$ 25 | \$49 99 |
| \$ 50 | \$99 99 |
| \$100 or more | \$5 50 |

Jaycar

Shop Hours:
Mon — Sun —
9AM — 5.30PM



380 Sussex St Sydney 2000. Ph 264 6688



Cat Y-2100

HEY EXPERIMENTERS...LOOK AT THIS! Amazing 'CALL JOTTER' Telephone Answering Machine

YES, you can afford this one! This is the affordable answering machine that can be connected to any phone and comes complete with its own AC power supply. BUT IT'S MORE THAN AN ANSWERING MACHINE.

- As a phone monitor
- As a dictation/transcriber for the business person.
- As a tape recorder - play your favourite cassettes on it!
- Uses standard cassettes!!!

And with all these features, it'll GET YOUR MESSAGES THROUGH TO YOU! NOTE: This machine is not Australian Telecom Approved. See catalogue for our other answering machine which is approved.

ONLY
\$99⁵⁰

THEY'RE TURNING GREEN!

When they look at my price for this fantastic GREEN SCREEN MONITOR! Compare the others against ours & you'll find us on top. Features an ultra high resolution (not found in other more expensive units) and it's absolutely complete and ready to go. Great for hobbyists, etc. who want to build their own computer console. This would also be the PERFECT MONITOR for use with our NOVA 80 computer kit. Hurry - there is only a limited number in stock! Cat. X-1199



\$175

FOR SAFE KEEPING...

Cat. D-1102

\$49⁵⁰

BUDGET KEY

For the novice or anyone who wishes to learn the code. Spring tension adjusts. As used in the Morse Practice kit in Dick Smith's Funway kits. Cat. D-7105

\$175

LEARN THE CODE

Teach yourself Morse. Learn Morse the easy way. These tapes will teach you in the convenience of your own home (or shack). Speeds from 5wpm to 15wpm in graduated steps. Ideal for Novice licence or 'Z' calls. GIVE IT A GO!! Cat. D-7106

\$790

COLOURED GLOBES

Great 100W par 38 floodlights in 4 colours:
Yellow S-3850
Red S-3852
Blue S-3854
Green S-3856

\$795EA

PARTY TIME!

Get your party going with this versatile Muscular kit. Accepts an audio input from almost any amplifier and uses the information to control 3 channels of light. Easy to build. It will provide endless enjoyment to you and your friends. Cat. K-3140

\$69⁵⁰

YOU ASKED FOR IT - YOU GOT IT! The new 3.5MM STEREO PLUG & SOCKET!!!

HOLDERS: \$3.50ea.
(not illustrated)

These new plugs & sockets are much sought after by project builders and experimenters. Both plug & socket are extremely versatile where space is a problem. The plug suits our micro-sized cassette recorder headphones (see catalogue) PLUG P-1140 75c. SOCKET P-1240 95c.

COMING SOON!

OUR SWITCHES ARE BEST!

Our most popular switches. Low in cost, high in quality. Ideal for many applications.

- DPDT Sub Mini Slide Sw. S-2010 40c ea
- SPDT Toggle 240VAC 1.5A S-1173 \$1.45
- SP Mini Push Button, Nor open S-1102 45c
- DPDT Toggle Sw. 240VAC 3A S-1393 \$2.75

We have micro switches, pushbuttons, rotary switches, illuminated switches, PCB Oil switches & MUCH MORE! Compare our prices. You'll save even more if you buy in bulk!

DROP IN & SEE OUR HUGE RANGE!

TEST IT!

Tests bipolar transistors, FETs, diodes & even SCR's & PUT's. Easy to build & is ideal for beginners, servicemen & schools. A valuable piece of test equipment! Cat. K-3052

\$85

LOVELY NEG IONS

Mountain air in your office? Yes - with this negative ion generator. Get rid of bad smells, dust & other particles. Doesn't produce harmful Ozone. Cat. Y-9000

\$125

12V FLUORO \$125

Take anywhere portable fluoro light comes complete with cigarette lighter plug. Use a map reading light, for the caravan, boat, garage etc. Well...not quite, but this inexpensive unit can mix 4 signals (mic, tuner, T table etc) into 1 signal for amp or recorder. Cat. F-2272

\$1495

THROW THOSE TOYS AWAY...

Now's the time to use a PROFESSIONAL METAL DETECTOR with a discrimination feature that indicates treasure from rubbish! It's professionalism is only offset by the fact that it's easy to use. So now you can learn to master the detector quickly. The latest in microprocessor technology is employed but that's not all - look at my price.

Just \$149

WHO KNOWS...IT COULD LEAD YOU TO A FORTUNE!!!

THOUSANDS SOLD!

WATCH THIS SPACE AND FIND OUT WHAT YOU MISSED

Each month all of our stores feature an outstanding special which is actually BELOW COST! NB Specials are strictly while store stocks last. Don't miss out!

LAST MONTH: VERSATILE TOOL BOX. Cat. H-2600 Was \$22.90. Reduced to \$14.12! SAVING \$8.78!

WHAT A PICK-UP!

Great for many projects. You'll save heaps! Check these features:

- Loop stick AM antenna
- Accepts 12-16V DC
- Overload protection
- Built in FM muting
- Built in 19kHz notch filter
- MPX stage
- Output preamp
- High image rejection - over 50dB!

PUS MUCH MORE!

\$69⁵⁰

Cat. F-4610

GREAT NEW SOLAR CELL!

This is a solar cell sector with a very high output -450mV @ 95mA (45mW per cell). Join them together for higher outputs in voltage & current. The versatile 60 degree segment can be joined together to form a 60mm dia. circle (in 6 parts) with over 2.5 volts output! What's more, IT'S EASY TO SOLDER TO! Think of the applications!!! Z-4830C

\$250

Learning has never been so enjoyable...

SPEAK & SPELL

Develop your child's skills in spelling, pronunciation & reading. The unit pronounces the word while the student keys in the spelling. It tells you if you're right or wrong & even keeps a score! Has a vocabulary of over 200 most commonly miss-spelt words. Complete with 32 page guide. Cat. Y-1300

\$79.00

SPEAK & READ

Develop your child's vocabulary word meaning & reading comprehension. Offers 6 games & activities to play. Use alone or with friends. Makes it ideal for migrant English education! Complete with 64 page book 'You can Read!' Cat. Y-1313

\$99.00

SPEAK & MATH

The microprocessor IC in this unit can generate over 100,000 math problems & talk to you, giving you a problem & telling you if you're right or wrong. Added games make learning fun. Supplied with 32 page book 'Math Talk'. Each unit has a battery saver device. Cat. Y-1310

\$89.00

SWITCH IT! FILTER IT!

With this 3-way antenna switch, your problems are over! Use up to 3 antennas for your CB Ham radio. Handles 150 watts at 30MHz. Ideal for base or mobile use! Cat. D-5206

\$1175

PARTS FOR NEW KITS

See also our advert elsewhere in this magazine with new kits since our last catalog.

HOT CANARY (See EA May)
Complete kit, inc. inst. K-3395 \$14.95
PCB only H-8396 \$2.25

SPEED SENTRY (See EA May)
Complete kit, inc. inst. K-3245 \$11.75
PCB only H-8399 \$1.95

INFRA RED REMOTE CONTROL (See EA May)
Full kit, inc. inst. K-3380 \$63.95
PCB only H-8397 \$6.95

dB METER (See EA May)
Complete kit, inc. inst. K-3476 \$34.50
PCB only H-8398 \$2.35

UHF TV DOWNCONVERTER (See ETI May)
Full kit, inc. inst. K-3235 \$32.50
PCB only H-8637

UNIVERSAL RELAY DRIVER (See ETI May)
PCB only H-8638
(All parts for this kit are normal stock lines)

SYSTEM 80/TRS 80 SERIAL INTERFACE (See EA April)
Full kit, inc. inst. K-3608 \$57.50
PCB only H-8394 \$7.95

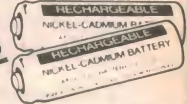
INFRA RED BEAM RELAY (See EA April)
Full kit, inc. inst. K-3375 \$37.50
PCB only H-8395 \$3.95

CORE BALANCE RELAY (See ETI April)
Full kit, inc. inst. K-3315 \$49.50
PCB only H-8635 \$4.50

NEGATIVE ION GENERATOR (See ETI April)
Complete kit, inc. inst. K-3335 \$41.95
PCB only H-8634 \$3.95

(Above prices & dates are from magazine estimates only. We cannot guarantee that the articles will appear when specified. * Price unavailable at time of going to press.)

NEW NICADS



Want to save a heap on batteries? Try these value-packed Nicads! They're dearer at the start, but you can charge them over and over again! And now we have 'C' & 'D' size Nicads, too, at bargain prices! So why not up-date now and start saving!

NOTE: 'C' & 'D' Nicads come in packs of two, 'AA' size Nicads are supplied individually

'C' SIZE 1.2Ah Cat. S-3302 Pk 2: \$7.50
'D' SIZE 1.2Ah Cat. S-3304 Pk 2: \$7.95
POPULAR 'AA's Cat. S-3300 Each \$2.05
Save more if you buy in bulk!!!

NICAD BATTERY CHARGER

Great for charging anything up to 12 volts! Will charge from six to ten 1.2 Volt batteries at a time. The current automatically adjusts FULLY APPROVED and it's only Cat. M-9517

\$11⁵⁰

WOULD YOU LIKE TO WORK WITH US?

Dick Smith Electronics is expanding - if you've been watching your local press you'll probably have noticed this already! Opening new stores requires new staff. Good staff. Electronics enthusiasts who can be trained to become professional sales people and managers. If you're talented and enthusiastic, we offer good wages and conditions. If you're above average, promotion can be very rapid. (One of our salesmen became general manager three years later!)

No matter what area you live in, if you'd like to work with us, drop us a line. When we open a store in your area, we'll be in touch...

Send your application to:
The Personnel Manager,
Dick Smith Electronics Pty Ltd
PO Box 321,
North Ryde, NSW 2113

WOULD YOU LIKE TO BE A DICK SMITH RE-SELLER?

How would you like to join the hundreds of successful Dick Smith re-sellers, spread right across Australia? If you're interested, why not give our wholesale division a call - Sydney (02) 888 3200 9AM - 5.30PM weekdays. It could be the start of something big...

A NEW GENERATION IN UHF CB...

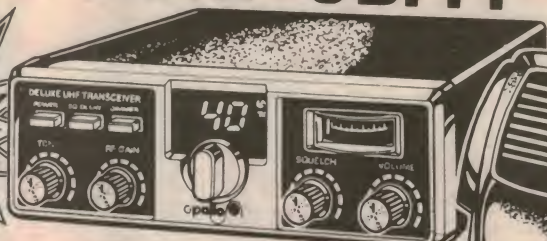
The deluxe Apollo 40 ch UHF Transceiver

Until now, you've really had no choice in buying a UHF transceiver. With the new Apollo AP400 you'll surprise your contacts with a good clear sound - standing out from the crowd. This amazing breakthrough in UHF technology makes it ideal for small business or rural applications. Great for use in the car on the way to work or as a home installation. On air signal is strong and clear while the powerful receiver has a high selectivity to eliminate cross channel interference.

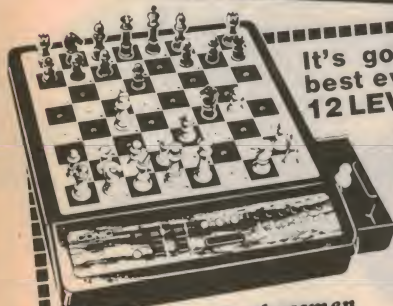
Just look at these features:

- Large illuminated SRF meter.
- Delayed action squelch circuit.
- RF gain control.
- Tone control
- Green LED channel indicator for sharp image - even in daylight!
- Dimmer switch
- Performance you just couldn't find in less expensive equipment.

\$379



Cat D-1802



It's got to be the best ever so far... 12 LEVEL CHESS COMPUTER

This magnificent and attractive unit has 12 different levels of skill enabling you to learn gradually. It even plays against itself! A must for any professional or serious chess player. You'll have to see for yourself the number of incredible features it has.

Don't pay \$1000 or more - our price is only:

\$245⁰⁰

Complete with chessmen and power supply!

Learning to play Chess?

Improve your skills with this Chess Master learning aid. You can soon play like a professional! Solve problems in the least number of moves. Play alone or with others and experience the different tactics and checkmates etc. Complete with 7 booklets each containing 50 moves - that's 350 moves to play!

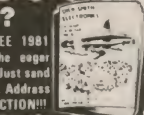
\$35⁰⁰

Cat Y-1257



Did you miss out?

Last month EA & ETI included our FREE 1981 catalogue, packed with goodies for the eager enthusiast. If you missed out, don't worry. Just send 75c (P&P is free) to our Mail Order Centre. Address below. INCLUDES 30 PAGE DATA SECTION!!!



PROTECTION COMMUNICATION



Too many intruders? This unit won't let them pass the door. If they try, they'll encounter a piercing siren. Also features pleasant ding dong sound - so you don't scare your friends! The 15 buttons enable you to pick your own secret code, so you can switch it off when you get home.

\$29⁵⁰

Cat L-5100

OOPS!

Catalogue Correction

Due to an oversight, the price and catalogue number for a discontinued printer were shown on page 6. The correct catalogue number for our new low-cost printer is X-3252 and the price is \$495.00. Our apologies for any inconvenience caused.

Dick Smith & Staff

WHOLESALE MAIL COMPETITION PRIZE WINNERS

Thanks to all who entered our wholesale Give-away competition for a fabulous System 80 computer and other great goodies. We received thousands of entries.

Congratulations to:

- Graeme Ryder: Jindabyne NSW - 1st prize Dick Smith System 80 16K personal computer
- Stephen Morton: Nightcliff NT - 2nd prize Dick Smith Telephone Answering Machine complete with remote beeper
- Colin Laidley: Coffs Harbour NSW - 3rd prize Sanyo Stereo Cassette Deck with Dolby Noise reduction

PLUS 100 FUNWAY VOLUME 2 BOOKS GIVEN AWAY!!!

Once again, thanks to all who participated

Dick Smith & Staff

FOR THE LOVE OF BOXES!



Superbly made folded aluminum cases in a variety of sizes, fitted with rubber feet and have ventilation slots. Look really great!

| SIZE | CAT | 1-9 | 10 up |
|----------------|------------|--------|--------|
| 102 x 56 x 83 | Cat H-2741 | \$2.75 | \$2.55 |
| 150 x 61 x 103 | Cat H-2742 | \$4.35 | \$3.95 |
| 150 x 78 x 143 | Cat H-2743 | \$4.90 | \$4.40 |
| 184 x 70 x 180 | Cat H-2744 | \$5.45 | \$5.00 |

DICK'S ZIPPYS ARE BEST!

Dick Smith zippy boxes are unique: they're the ones with slotted sides allowing for easy mounting of PCB's etc. Insist on them!

| SIZE | Cat No. | 1-9 | 10 up |
|------------|---------|--------|--------|
| 150x90x50 | H-2751 | \$2.50 | \$2.00 |
| 196x113x60 | H-2752 | \$3.75 | \$3.00 |
| 130x68x41 | H-2753 | \$1.95 | \$1.60 |
| 85x54x28 | H-2755 | \$1.50 | \$1.20 |



Our 2nd Perth store is NOW OPEN

Hey you lucky Western Aussies, you've got another store! You'll find the same reliable & friendly service and a wide range of goodies for the electronics enthusiast and professional. We're just a short walk from the Carousel shopping centre at the corner of Albany Highway and Wharf St. Ph. 451 8666. SEE YOU THERE!



DICK SMITH ELECTRONICS



- NSW**
- AUBURN: 145 Parramatta Rd. 648 0558.
 - BLAKEHURST: 613 Princes Hwy. 546 7744.
 - BROADWAY: 818 George Street. 211 3777.
 - BROOKVALE: 531 Pittwater Rd. 93 0441.
 - CHULLORA: 147 Hume Hwy. 642 8922.
 - GORE HILL: 162 Pacific Hwy. 439 5311.
 - PARRAMATTA: 30 Grose Street. 683 1133.
 - SYDNEY: 125 York Street. 290 3377.
 - WOLLONGONG: 263 Kiera Street. 28 3800.

DICK SMITH MAIL ORDER CENTRE:

PO Box 321, North Ryde, N.S.W. 2113. Ph: (02) 888 3200.

SERVICE CENTRE: LANE COVE & WATERLOO RDS, NORTH RYDE NSW 2113. PHONE (02) 888 3200. 9AM TO 5PM, MONDAY TO FRIDAY ONLY.

- ACT**
- Fyshwick: 96 Gladstone Street. 80 4944.
- QLD**
- BURANDA: 166 Logan Rd. 391 6233.
 - CHERMSIDE: 842 Gympie Rd. 59 6255.
 - ADELAIDE: 60 Wright Street. 212 1962.
 - MELBOURNE: 399 Lonsdale Street. 67 9834.
 - RICHMOND: 656 Bridge Rd. 428 1614.
 - SPRINGVALE: Dandenong & S'vale Rds. 547 0522.
 - PERTH: 414 William Street. 328 6944.
 - CANNINGTON: Wharf St & Albany Hwy. 451 8666

SHOP HOURS: 9AM TO 5:30PM MONDAY TO FRIDAY. NOON SATURDAY (Brisbane stores half hour earlier). Some stores are open on late shopping nights: please phone your local store to check before coming in!

PRICES CORRECT FOR MONTH OF PUBLICATION OR WHILE STOCKS LAST.

MAJOR DICK SMITH RE-SELLERS:

Listed below are re-sellers who stock a large proportion of our range. However we cannot guarantee that they will have any or all of the items, or at the same prices, as those shown here.

- ATHERTON, QLD:** Tebleland Radio Service
2 Jack Street Phone 912 017
- BENDIGO, VIC:** Sumner Electronics
95 Mitchell Street Phone 431 977
- BLACKHEATH, NSW:** Goodwin Electronics
123 Station Street Phone 878 379
- BROKEN HILL, NSW:** Crystal TV Rentals
66 Crystal Street Phone 6897
- CAIRNS, QLD:** Thompson Instrument Services
79-81 McLeod Street Phone 512 404
- COFFS HARBOUR, NSW:** Coffs Harbour Electronics
3 Coffs Harbour Plaza, Park Ave Phone 525 684
- DARWIN, NT:** Kent Electronics
42 Stuart Highway Phone 814 749
- DUBBO, NSW:** Seleka Sound
31 Talbair Street Phone 826 979
- EAST MAITLAND, NSW:** East Maitland Electronics
Cnr Lewis & High Streets 337 327
- FAIRY MEADOW, NSW:** Trilogy Wholesale Elect.
40 Princes Hwy Phone 831 219
- GERALDTON, WA:** KB Electronics & Marine
361 Main Terrace Phone 212 176
- GOSFORD, NSW:** Tomorrow's Electronics & Hi Fi
88 William Street Phone 247 246

- HOBART, TAS:** Aero Electronics
123a Bathurst Street Phone 348 232
- KINGSTON, TAS:** Kingston Electronics & Records
Chenell Court Phone 296 802
- LAUNCESTON, TAS:** Advanced Electronics
56 The Quadrant Phone 317 075
- LISMORE, NSW:** Decro Electric
Magellan St & Brunner Hwy Phone 214 137
- MACKAY, QLD:** Stevens Electronics
42 Victoria Street Phone 511 723
- MARYBOROUGH, QLD:** Keller Electronics
218 Adelaide Street Phone 214 559
- MORUYA, NSW:** Coastal Electronics
43 Vulcan Street Phone 742 545
- MT GAMBIER, SA:** Hutchesson's Communications
5 Elizabeth Street Phone 256 404
- MUSWELLBROOK, NSW:** Silicon Chip Electronics
Suite 3, 98 Bridge Street Phone 43 1096
- NAMBOUR, QLD:** Nambour Electronic Shop
Shop 4, Lowen House, Ann St Phone 411 604
- NEWCASTLE, NSW:** Electron 2000
181 Wharf Road Phone 262 644

- ORANGE, NSW:** M&W Electronics
48 McNamara Street Phone 626 491
- ROCKHAMPTON, QLD:** Purely Electronics
15 East Street Phone 21 058
- SOUTHPORT, QLD:** Amateur's Paradise
121 Naresing Street Phone 322 644
- TAMWORTH, NSW:** Sound Components
78 Brisbane Street Phone 661 363
- TODWOMBRA, QLD:** Hunts Electronics
18 Neil Street Phone 326 944
- TOWNSVILLE, QLD:** Tropical TV
49 Fulham Rd, Vincent Village Phone 781 421
- TRARALGON, VIC:** Power N' Sound
147 Argyle Street Phone 743 638
- WAGGA, NSW:** Wagga Wholesale Electronics
82 Forsyth Street
- WINDSOR, NSW:** Hawkesbury Electronic Centre
111 George Street Phone 773 411
- WOODONGA, VIC:** A & M Electronics
78a High Street Phone 244 588
- WYALLA NORRIE, SA:** Mellor Enterprises
Shop 2, Forsythe Street Phone 454 764

BUYING BY MAIL?

ORDER VALUE:

| | |
|---------------------|--------|
| \$5 (min) to \$9.99 | \$1.00 |
| \$10.00 to \$24.99 | \$2.00 |
| \$25.00 to \$49.99 | \$3.00 |
| \$50.00 to \$99.99 | \$4.00 |
| \$100 or more | \$5.00 |

P&P

NOTE: These charges apply to goods sent by post in Australia only. Large and bulky items cannot be sent by post. If you prefer, we will dispatch your order by Comet Road Freight to anywhere in Australia for only \$7.00 (that's below what it costs us!) Large and bulky items are normally sent by Comet unless you specify differently (eg by rail or air - you pay freight on delivery).

COMPUTER HOTLINE

Want to know more about our computers? Or maybe you're having problems and need advice. For friendly, helpful information on System 80 or Sorcerer computers, or on any of our peripherals, phone our Computer Hotline:

Monday - Friday 9 - 5.30 on Sydney (02) **888 2002**

Dear Customers,

Quite often, the products we advertise are so popular they run out within a few days. Or unforeseen circumstances might hold up goods so that advertised lines are not in the stores by the time the advert appears. Please don't blame the store manager of staff; they cannot solve a dock strike on the other side of the world, or even locate a shipment that has gone astray.

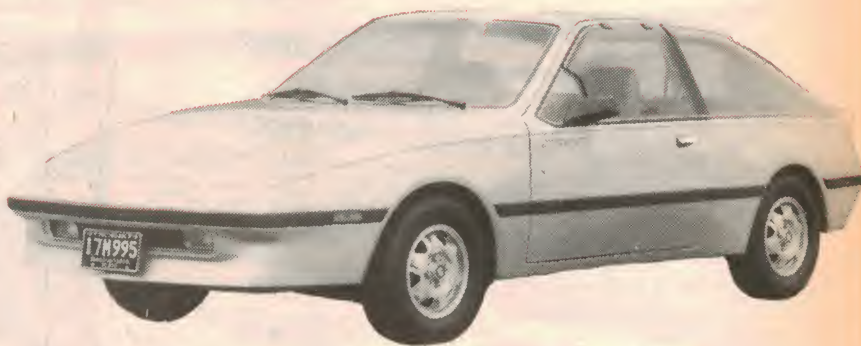
What we are trying to say is that if you are about to drive across town to pick up a particular line at a Dick Smith store, why not give the store a ring first (addresses and phone numbers opposite) just in case! Thanks

Dick Smith and Staff

There's a re-seller near YOU!

Electric vehicles must come

But don't hold your BREATH!



Electric vehicles have been "just around the corner" for years now. In this article the author reports of recent developments in Britain.

by BRIAN DANCE

There is enormous interest in the development of electrically powered vehicles throughout the world at the present time. Undoubtedly much of this interest has been created by the escalating prices of hydrocarbon fuel, but even without this factor electric vehicles have many advantages which make them attractive. For example, electric vehicles are much quieter than petrol driven vehicles and are far quieter than diesel powered vehicles. In addition, electric vehicles do not pollute the atmosphere, (although the power station supplying the electricity does).

In view of these advantages, one may well wonder why it is that we do not see many more vehicles powered by electricity on our roads today. In fact, many electrical vehicles are used in factories for moving fairly heavy items over relatively short distances and in Britain the daily delivery of fresh milk usually arrives by an electrically powered "milk float". But there are few other electrical vehicles on the roads at the present time.

Limitations

The main disadvantage of the electric vehicle at the present time is that the total amount of energy which can be stored in a battery system of reasonable size and weight is rather limited. For example, the 66 small electric Enfield cars purchased by the British Electricity Council for long term tests had a range of bet-

ween 39 and 90km from a fully charged set of batteries, while most electric vehicles designed for commercial use have ranges of around 80km.

Another disadvantage of the electrically powered vehicle is that its maximum speed is normally much less than that of a typical petrol or diesel powered vehicle of similar design. For example, the Enfield 8000 car is quoted as having a maximum speed of some 64km/hour with an acceleration time from rest to 48km/hour of 12.5 seconds. In Britain it can occasionally be annoying to have to drive behind a milk truck travelling at a very slow speed in road conditions where one is unable to overtake it.

Thus the present situation is that electrically powered delivery vehicles for urban use are a reality. Practical electrically powered cars are much more difficult to design simply because the average motorist expects to be able to use his vehicle not only for regularly commuting a few tens of kilometres each day to and from the office, but also for much longer journeys when on holiday or on long business journeys.

No car is likely to be successful and sell in very large numbers if there is much possibility of the battery becoming discharged and leaving the occupants of the car stranded in some isolated place. Although many people feel that this problem will be solved with the development of an advanced battery which would extend the operating range of an

electrically powered vehicle, it still would not provide the flexibility one expects of the modern vehicle.

A possible solution would be an extensive chain of stations able to exchange vehicle battery systems quickly and economically. However, this is not very practical, since large battery systems for vehicle propulsion take time to change and the cost would be appreciable especially if a service vehicle had to make a long journey to do the work. In addition, such an extensive chain of service stations would not be economically feasible until a very large proportion of cars were electrically powered. It is the old story of "Which comes first, the chicken or the egg?"

The hybrid

Many people feel that the "hybrid" vehicle is the best proposition for the small car, since it would offer the full mobility of a conventional petrol powered car, but with greatly reduced fuel consumption. Such a car would have both an electric motor and a small petrol engine.

In Britain, Lucas Industries Ltd is considering both "series hybrid" and "parallel hybrid" cars. Series hybrid

TOP OF PAGE: Front-wheel drive and microprocessor control are features of this GE/Chrysler electric car. Vehicle is powered by 18 lead-acid batteries.

vehicles employ a petrol engine to drive a generator which charges the battery system, whereas in the parallel hybrid system the petrol engine can be directly coupled to drive the wheels.

A series hybrid vehicle can have quite a small petrol engine, since it must provide only the average power required for the journey and not the much higher peak power required to climb a hill or to accelerate rapidly. Although the electric motor of a series hybrid vehicle tends to be larger than that required in a parallel hybrid type, the motor can be used to recover power from regenerative braking. In this type of braking the motor is used to convert some of the kinetic energy of the vehicle into electricity which is stored in the battery system.

However, Lucas feel the parallel hybrid type would probably provide the best fuel economy when used in heavily congested urban areas linked together by long stretches of open roadway. In areas of higher population density, where a journey may consist of long stretches of slow, congested major roads in addition to the high traffic densities found in inner cities, the series type hybrid may well be the more sensible choice.

At the present time Lucas is working on the series hybrid type of vehicle, which is felt to be more attractive for British conditions.

Lucas are aiming their hybrid vehicle design at motorists who commute some 30 or 40km to work each day and who occasionally make much longer journeys. Petrol would be used only on the longer journeys and then only for a part of the journey.

The charging of a battery from a petrol engine followed by conversion of the chemical energy of the battery into mechanical work is much less efficient than using the petrol engine to drive the wheels directly; thus on such parts of the journey Lucas feel the petrol consumption may be quite high (perhaps about 9km/litre). However if such journeys amount to only about 10% of the total distance, the average petrol consumption could be some 90km/litre — plus the cost of the electricity used to charge the vehicle batteries.

This charging would be done at night, taking advantage of the cheaper off-peak electricity rates available in many countries.

Practical driving

Electric vehicles are somewhat different to drive than petrol or diesel vehicles. Although electric vehicles are quieter, they are by no means silent. There is the whine of the thyristor controlled electric motor instead of the noise of a conventional engine, which contains most of its energy in the lower frequency regions of the audible spectrum.

When an electrical vehicle is stationary, no noise whatsoever is emitted by its power system. Thus if the vehicle is stationary at traffic lights, you have to



Lucas/Bedford electric van with detachable battery pack withdrawn for maintenance. (Photo courtesy Lucas Industries Ltd.)

concentrate on the fact that you do not need to operate a starter motor to restart a stalled engine!

In general, driving an electric vehicle is slightly simpler than driving comparable petrol-powered vehicles. All one does is release the handbrake and push one's foot on the accelerator to move the vehicle away from rest.

Electric vehicles must have their batteries recharged, normally after each day of use. The batteries must also be topped up with distilled water at suitable intervals and this can be quite a task with many cells to be checked. To overcome this, the Chloride group has developed an "Autofil" system which simplifies the topping up process. Autofil is an air-lock operated control plug which is fitted to each cell. The plugs are interconnected by tubing. Water is fed to the first cell in the topping-up circuit from a reservoir and is then drawn through the system by a suction pump attached to the last cell in the circuit. This system enables the battery to be automatically topped up to the correct level, thus saving time and reducing maintenance costs.

Batteries

The battery is the most costly part of an electric road vehicle. At the present time, lead-sulphuric acid batteries are employed for powering vehicles. There

are two main forms of this type of battery; one employs tubular and the other flat plate positive cells.

Tubular cells are much used in fork-lift trucks because they can deliver power at a higher level than flat plate cells. They derive the name "tubular" from the construction of their positive grid plates which consist of a lead top attached to a number of round lead rods; each of these rods is encased in an individual tube (usually made of polyester or fibreglass) filled with a paste of lead oxide. The negative grid is flat just as in flat plate cells.

Tubular cells tend to be more compact. The relatively large surface area of the anode combined with the ease with which the electrolyte circulates around the anode material enables a high rate of delivery of the stored energy.

On the other hand, cells in which both plates are flat have better ability to recover after deep discharges and a more gradual rate of deterioration.

Much work has been put into improving lead-acid batteries for traction purposes in the past few years, the main aim being to obtain more power without increasing the weight, volume or cost of the product. For example, the Chloride Company is using aluminium connectors instead of lead for connecting cells and this achieves a useful saving in weight.

Electric vehicles — problems still remain

Battery developments

As the battery used determines the range of an electric vehicle, the importance of developing new and improved battery systems cannot be overestimated. The British Chloride Company has recently signed an agreement with the US General Electric Company to pool resources in the development of a lightweight, high-power sodium-sulphur battery which must operate at about 350°C. Another possibility is a lithium-sulphur battery operating at about the same temperature, although the sodium-sulphur battery is the stronger candidate.

In the USA, Gulf and Western has developed a zinc-chlorine cell which holds great promise even though many problems remain to be solved. General Motors has developed a zinc-nickel oxide cell and has forecast that it will use this in the electric car it plans to produce in quantities of 100,000 per year by 1985. Nickel-iron cells also show much promise for use in the near future.

The Chloride Company says that sodium-sulphur batteries will increase the range of an electric vehicle to about three times that of a similar vehicle powered by lead-acid cells, although lead-acid cells will still be used for powering vehicles with less demanding duty schedules. One advantage of the sodium, sulphur battery is that the electrode materials are cheap and plentiful.

Most batteries have solid electrodes and liquid electrolytes, but the sodium-sulphur cell is operated at a temperature at which both its electrode materials are molten. The sodium and the sulphur are separated by a solid electrolyte, beta alumina. This electrolyte will allow sodium ions to pass through it, but cannot be penetrated by the uncharged atoms.

Sodium and sulphur are both relatively light atoms and it is this which enables this type of battery to have a high stored power to weight ratio. It can store up to five times the energy of a conventional lead-acid battery per unit weight and up to three times the energy per unit volume.

Sodium-sulphur cells do not contain any aqueous electrolyte and do not produce any gas at all during the recharging process. The cells are therefore hermetically sealed and require no maintenance.

The sodium-sulphur cell has the construction shown in Fig. 1, the cell being a tubular shape. When a current is taken from this cell an electron from an atom of sodium passes through the steel case (which is the negative terminal) to the external circuit. The positively charged sodium ion remaining can then pass through the beta alumina to the sulphur with which it combines to form sodium sulphide. In order to do this it extracts an electron from the positive central elec-



The Dodge 50 Electric Vehicle developed by Chloride Technical Ltd. Battery packs can be seen to the side and to the rear of the vehicle.

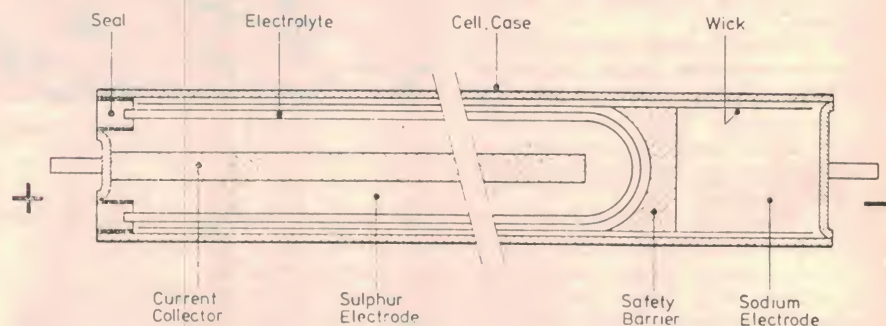


Fig. 1: basic scheme for a 300Whr sodium-sulphur cell (Chloride Technical Ltd).

trode of the cell. The cell is fully discharged when all of the sodium and sulphur has been converted into sodium sulphide. Carbon felt must be added to the sulphur, since without it the sulphur is a very poor conductor.

As the sodium is gradually transferred through the solid electrolyte to the sulphur electrode, the level of sodium falls and thus normally reduces the area of the electrolyte wetted by the metal. This would cause an increase of the internal resistance of the cell during discharge and a gradual reduction in the available power. An iron foil wick was therefore developed which fits tightly around the electrolyte, forming a capillary annulus which is filled with sodium. If the bottom of this wick is filled with sodium, the whole of the electrolyte surface is wetted by capillary action, so that the initial quantity of sodium required in the cell is that amount needed to produce the rated cell capacity plus a small amount to preserve contact with the wick.

In a practical cell the wick is constructed in a sandwich form from two layers of iron foil separated by graphite paper. The latter provides a safety barrier, since it prevents the active material from penetrating the cell case if the electrolyte is cracked. The massive metal barrier between the electrolyte (which contains the sulphur electrode) and the sodium electrode also provides a further safety measure.

Each sodium-sulphur cell is 850mm in length and 38mm in diameter and can store 300Whr of electrical energy. The EMF is 2.08V. Although it was initially planned to operate these cells in a vertical position, this is not compatible with vehicle design and the cells will therefore be placed horizontally.

A battery will consist of a number of these cylindrical cells packed into a prismatic container with thermally insulated walls. The battery would be initially heated to its working temperature using internal electric rod heaters powered from the mains. The thickness

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Electric vehicles — don't hold your breath!

and quality of the thermal insulation would be designed to keep the battery at its working temperature for about 48 hours. During its normal cycling operation the heat dissipated in internal resistance combined with the heat associated with entropy changes will be adequate to maintain the operating temperature of the battery.

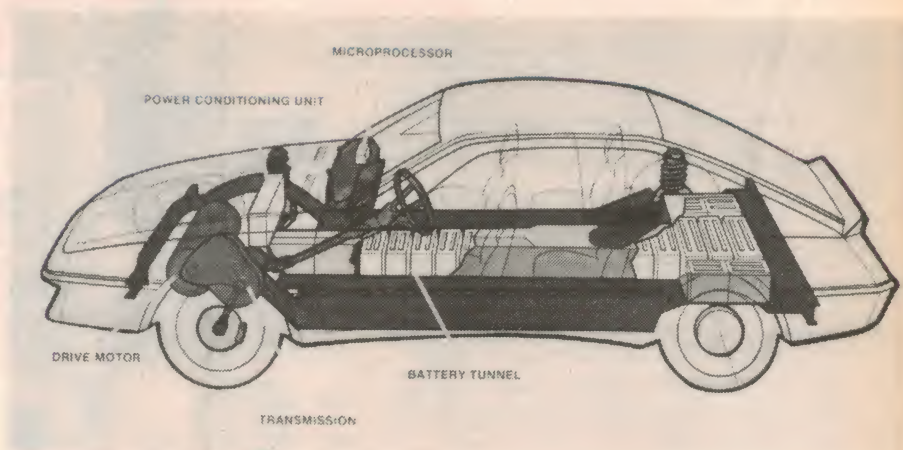
Unfortunately the requirement for thermal insulation tends to reduce the energy density of this type of battery. In the case of large batteries exceeding 50kWh capacity, this is a minor effect and energy densities of the order of 150Wh/kg can be attained. However, the effect of the thermal insulation becomes more and more important as the battery becomes smaller and for batteries of under 10kWh there is little advantage to be gained over the use of conventional batteries.

Sodium-sulphur battery design is currently oriented towards use in a 7.5 tonne delivery vehicle with a range of 120km; this range exceeds the normal daily duty runs of such vehicles.

Chloride and General Electric are aiming at a 1500-cycle lifetime for the sodium-sulphur battery. This has already been achieved, but not with all cells which have been produced. One of the main problems is still the random fracturing of the beta alumina ceramic electrolyte.

The motor

Electric motors for vehicles have various special requirements. They generally operate from between 24 and 96V, but in larger vehicles the operating voltage may be as high as 156V or



CUTAWAY VIEW of the GE/Chrysler electric car. Features include computerised electronic controls with pushbutton operation; a regenerative braking system that recovers energy during braking; an on-board battery charger; and an aerodynamic, lightweight body design. Driving range is 160km at 75km/hr.

sometimes even more. However, the generally low voltages result in heavy currents which require large copper cross-sections in the armature. The heat generated under peak load conditions cannot be dissipated immediately and the iron and copper in the armature must be used as a heat sink.

The motor used in the small Enfield car was a 4-pole, 6kW type which could deliver 20Nm (Newton/metres) at 2800 rpm with a peak torque of more than 150Nm.

Work is being carried out on variable reluctance motors at the Universities of Leeds and Nottingham. It is believed that the overall cost of such a motor and control system will be about 25% less than the best DC motor system. The electronic controller for a variable reluctance motor can be much simpler and therefore more reliable.

Another important item of equipment for electric vehicles is the battery charger. In the Enfield electric car a charger was built into the vehicle so that a mains power connector could be inserted just above the bumper bar at the rear of the vehicle. The initial charging rate was 30A, but this current tapered off with charge until the voltage reached 2.35V per cell, when a lower taper current was supplied for a variable timed period.

In the case of vehicles other than cars the charging equipment will not normally be fitted in the vehicle itself. However, it is vital that suitable charging rates are adopted to ensure satisfactory battery life.

Costs

The capital cost of an electric vehicle with its battery system and charger exceeds that of a similar petrol or diesel

powered vehicle. For example; Smith's Electric Vehicles Ltd quote the price of 1524kg payload petrol vehicle as £5416, a similar diesel as £6268 and a similar electric as £8160 (vehicle itself £4476, plus £3077 for a 36 cell 423Ahr battery, plus £607 for the charger). Thus electric vehicle capital costs are some 50% above the petrol vehicle at present.

On the other hand the electric vehicle scores on its low running cost (fuel/electricity, tyres and maintenance). In the case quoted this is £0.0603 per km as opposed to £0.135 per km for the petrol-engined vehicle and £0.117 per km for the diesel vehicle. If one makes certain assumptions, such as 45km per day duty cycle, reasonable depreciation and interest charges and the fact that no road tax is payable in Britain for electric vehicles, the overall cost per km travelled is about £0.16 for the electric vehicle, £0.24 for the petrol vehicle and £0.235 for the diesel vehicle. On this basis petrol and diesel vehicle running costs are nearly 50% more expensive than the electric design, all for a 1524kg payload capability.

The widespread use of electric road vehicles has been slow to develop, but a UK-Danish team believe that electric vehicles will take 5% of European sales by the year 2000 and 15% by the year 2025. It remains to be seen whether this forecast proves true.

It is, however, noteworthy that Chloride has been producing batteries for industrial fork lift trucks since the 1920s and that submarines use batteries as their only source of power when submerged. The Berix Company of Sweden has even produced a motorcycle which uses a 24V, 1.2kW electric motor and has a range of 129km. ☛

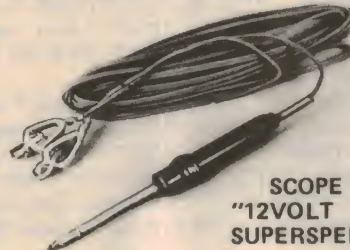

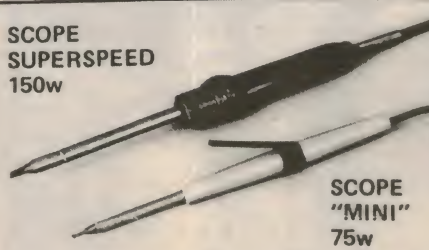


A sodium-sulphur cell. It measures 850 x 38mm and has an EMF of 2.08V.

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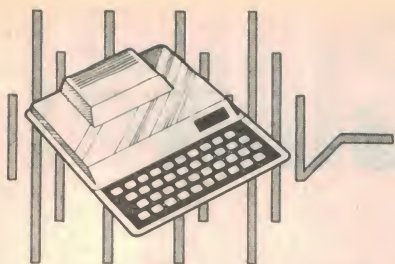
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Info banks

make your home computer smarter

One out of every four homes in the US will have a computer by 1985 — that's the prediction of many experts. In fact, it's already possible to link a home computer to a data service for all sorts of "instant information".

by WILLIAM J. HAWKINS

The computer terminal in front of me was black except for the small square cursor that showed where a word would come out on the screen.

I dialled a special phone number. The phone rang at the other end and a steady whining tone answered my call. Suddenly, the cursor began to move, leaving letters in its wake. I was now connected — "logged in", in computer jargon — to a remote computer system ready to supply me with information from more than 2000 data banks and computer programs.

No, I'm not in front of a giant IBM; I'm at home. And, at the push of a keyboard button, I can get anything from news to airline schedules to ball scores. I can even find out what wine goes best with tonight's dinner.

Computer information services are not new — businesses have been using them

for years. But now there are at least two new services in the US — called the Source and MicroNET — that are specifically aimed at individuals. They require little equipment, and the cost to sign up and use the systems is reasonable: from \$2.75 an hour on the Source and from \$5 an hour on MicroNET. Prices depend on time of day and other variables. There is also a one-time, initial hookup fee of \$100 for the Source and \$9 for MicroNET.

These new services are a quick and easy way for anyone to get information on virtually anything. But they go much deeper than just information retrieval. Their potential is enormous. They may change the way we live. Here's how they work.

"Big" computer power

Each time you type a request on the keyboard, the characters are sent over

phone lines to a remote computer — possibly thousands of kilometres away. (The consumer is billed only for a local phone call from most major cities in the country.) The computer finds what you're looking for, either in its own memory banks or from other computers it has access to, and sends the answer back, one character at a time, to your terminal. Your question is answered in seconds. And you don't need special gear.

"That's a standard Atari home computer," MicroNET's Mike Ward told me at a demonstration in Chicago. "All I've done is plug our 'conversation' software package into it. What you're seeing on the screen comes from MicroNET in Ohio."

Software — the programs that tell a computer what to do — has been developed by both MicroNET and the Source for Atari, Apple, and Radio Shack computers. Turn on your computer, load in the special software, and you're ready to go. It means that virtually anyone with a home computer can get big computing power simply and easily. Experts predict that by 1985 one out of every four homes in the US will have a home computer.

A computer in nearly every home? If that's to be, and if the information services are to grow, they must be simple to use — "friendly", in computer jargon.

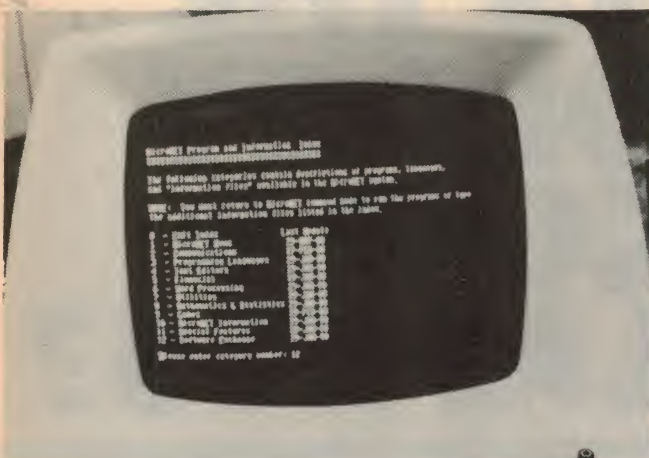
Push the wrong button on your computer, for example, and it politely tells you, adding instructions for future reference. Give it the wrong command, and you're quickly given the right one — or a guide to the right ones if the computer is not sure what you want. Use the wrong language — cuss at it — and you're warned to "clean it up" or your service will be cut off!

"We've recently changed our system," MicroNET's Ward told me, "to make it more friendly to everyone. It is now 'menu' oriented".

Author's home computer is an IMSAI equipped with an IDS 88-modem board for direct connection to the phone line. Data to or from the ADM terminal is processed through the computer. In that way, Hawkins can "grab" any screen of data and save it on disc for future use.



On the display



For instant information, just push a keyboard button. A selected airline schedule, left, appears from the Source. MicroNET's system, right, starts off with a "menu" of categories. Each display of data is numbered (by paragraph

or page) for quicker operation once you become used to it. In reality, the user is connected through a host computer system, such as Tymshare, which directs the data and allows many people to "share" a data computer.

In a menu system, the computer starts off with a simple list of general items: news, weather, games, special services, for example. Once you choose one, the computer branches to that category, giving you a more detailed menu of that particular subject. If you choose NEWS, it may come back with: WORLD NEWS, NATIONAL NEWS, LOCAL NEWS, OR BUSINESS NEWS? After you choose one of those, it then gets even more specific.

The Source will work that way, too, but you must first give it a command to display the main categories. If you don't want to go through the menu orientation (you know from experience precisely what you want and how to get it), you can type in a specific command to get a certain bank of information.

Data-bank index

When you subscribe to the Source, you also get a book of subjects listed in alphabetical order. Look up the subject — from gardening to card tricks — and type in the respective command. The problem, however, is keeping the book up to date, since the Source routinely adds programs to the system. Source's solution is a monthly magazine, *Sourceworld*, to keep subscribers informed of additions or changes.

Editor of *Sourceworld* and director of corporate communications for the Source is Noel Tyl. I visited him at the Source headquarters in McLean, Virginia.

"Welcome," he said as I entered his office. "Be right with you. Just answering some mail."

As he spoke, his fingers jumped over the terminal keyboard on his desk. "Sometimes I get as many as 30 letters a day," he said. "I try to answer them all, but some I must pass on to our customer service people."

"There!" he said, hitting the last button to send his electronic reply back to a

subscriber. "That's it for now, but the system tells me I've got four more letters waiting for me. Time for that later."

Electronic mail is just one of the additional features of a computer-operated communications system. It allows anyone to send letters to anyone else — either directly through the system or through a mail service that automatically delivers a telegram within 24 hours. It will go the other way, too.

"Suppose you're at the airport," said Tyl, "and you want to give a message to your wife, who's not home at the time. Just get to a phone, call the Source using a toll-free number, and dictate the message to one of our people. When your wife gets home and 'signs on' to the Source, the system tells her there's a message — and a typewritten copy of what you told us at the airport appears on her screen."

Except for the terminal, Tyl's office was surprisingly void of computer wizardry. Papers to be shuffled were on his desk, "people" pictures covered the walls, and ordinary clocks told the time — not a printout in sight.

"I don't know an RS-232 from a magnetic-tape drive," said Tyl, "and I don't want to. We're not offering a computer — that's just two boxes that look like refrigerators. We are offering an incredibly easy-to-use service. It's for everybody."

Before Tyl could finish, his phone rang. On the other end was a man from Indiana who had heard about the Source and wanted to know more.

"Give me a test," said Tyl. "What would you like to know?"

There was a moment of silence before Tyl began striking the keyboard again. "Let me get this straight," he replied, now trying to balance the phone between his shoulder and cheek. "You want to know what planes fly between Tel

Aviv and Cairo between noon and 3pm, right?"

Within seven seconds (yes, I timed it), Tyl began reading off the data from the screen to his caller. It included everything from flight numbers to the food that was being served.

Obviously, not everyone will get an answer in seven seconds. How well you do depends on how familiar you are with the system — as I found out.

Logging in

Although these systems may be friendly, they don't smile much unless they know who you are. You're given passwords and numbers that must be used in exactly the correct order or the computer assumes you're trying to get free information.

ILLEGAL PASSWORD, were the words across the screen on my first try. It is truly not comforting to have a computer tell you that you're a thief; stealing computer time is illegal — a gaolable offence. Would this thing call the FBI's computer? Would I hear sirens at my front door in moments?

PLEASE CALL YOUR SERVICE REPRESENTATIVE. Click.

"Thank goodness," I thought. All it did was hang up on me. My problem: One of the numbers I was given was wrong. That's understandable, since the sequence makes remembering your car registration number seem simple.

Once logged into the system, however, it can overwhelm you with helpfulness.

BALL SCORES, I typed after giving the command to get into the UPI news service, figuring I'd see how the Yankees were doing.

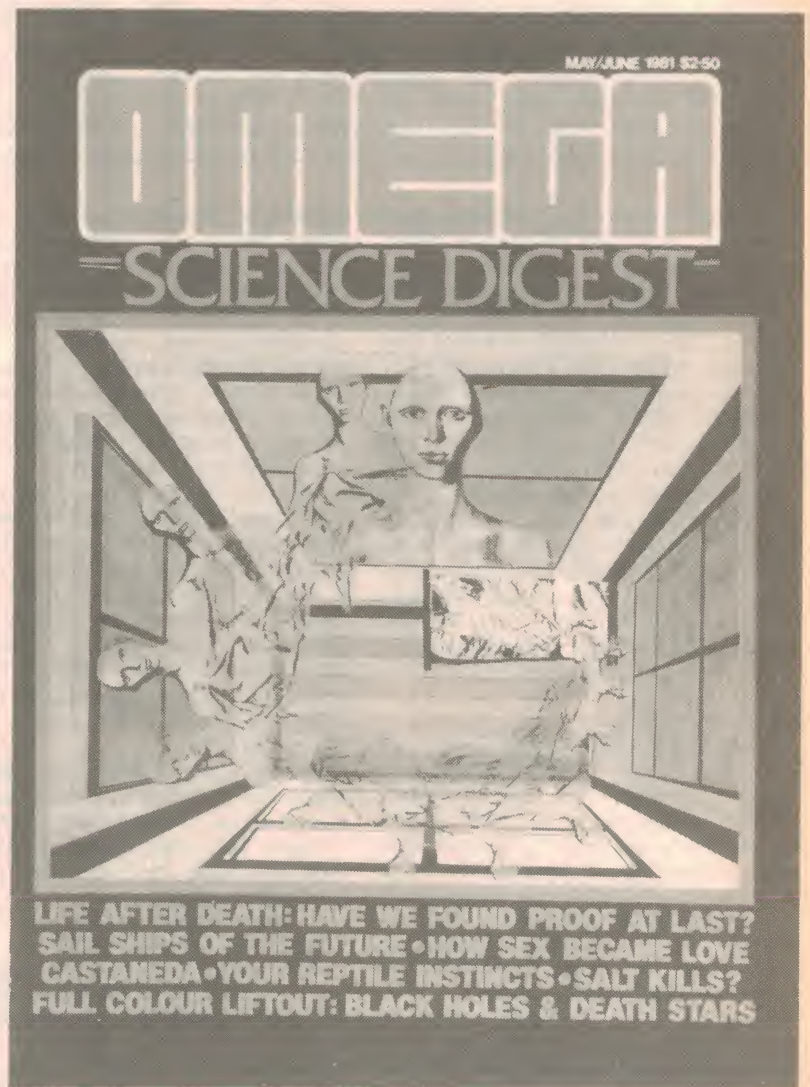
UPI NEWS SUMMARY, came the reply. BALL SCORES — MEXICO CITY.

Wait a minute. Mexico? No. STOP. QUIT, I typed. All in vain. Twenty

WHAT IS THE TECHNOLOGY THAT COULD MOVE PLANETS?

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NEWSAGENT**

minutes later (it seemed) the display of statistics covering ball games in Mexico finally stopped. I had learned a little about being more specific in my requests — and a lot about baseball in Mexico.

EINSTEIN, I typed, figuring you can't get more specific than somebody's name. Wrong again. What I got was a review of a new book, *Home Before Night — Memories of an Irish Time and Place*, in which he was referenced.

EINSTEIN, I tried again.

My next 10 minutes were spent reading a biography of Sigmund Freud, which, to my misfortune, compared him to Einstein. If this was the beginning of the electronic information age, I was ready for a good book.

EINSTEIN, DAMN IT! I typed, as I now found myself talking out loud.

SLAVE ABORT, came the response. BAD PASSWORD. Oh, well, I didn't want to know about him anyway.

Although your first few hours with these systems could be a bit frustrating, it's not long before you catch on and begin getting what you want. It wasn't long before my wife began using the system to get real-estate information and my five-year-old daughter started playing some of the games.

I also got to "talk" to other users on the Source's "Chat" program and MicroNET's clever "CB simulation" program. (It turns your terminal into a 40-channel CB set that lets you tune individual channels for other people on the system.) These programs let you communicate with anyone else — anywhere in the country. You type what you'd like to say on the keyboard, and the response comes out on your terminal. It's fun, but not fast. In a 20-minute conversation I had with someone in Boston, we exchanged only about 10 short paragraphs each. A phone call would have been quicker.

Some of the data banks I got into (either on purpose or by accident) brought up some interesting questions for the future of home information systems.

For example, if you want to take a trip, there's a travel agency on line that will help you with all kinds of information. But before getting it, you must sit through a short message giving the agency credit for the data. Understandable, but that's a commercial! Will Budweiser sponsor future ball scores? Could Gallo bring you the latest wine list? Will Phillips Milk of Magnesia present local restaurant guides?

Another feature of these systems is a "bulletin board" — you can buy or sell things, make dates (the Source's president's son made his first date over the system), or just post anything you'd like other users to know. The first time I "looked" at the bulletin board, I got: PUT JOHN ANDERSON ON YOUR BALLOT. It

was a political boost put there by the "Anderson for President" headquarters.

Could all of that mean future government control by, perhaps, the FCC or FTC? Naturally, with anything so new, there will be lots of questions — and problems — to work out. What makes this unique, however, is its overwhelming potential. Like TV, it could actually change the way an entire nation thinks.

What's ahead?

There are literally thousands of programs and data bases available on these systems, ranging from games to language-learning to stock questions — too many, in fact, to even try to list here. Right now, between the Source and MicroNET, you can get news headlines from a dozen national papers and the UPI and AP wire services. MicroNET alone has more than 30 other newspapers just waiting to add info to the system. The Source is presently negotiating for magazine material as well, and is working closely with the government on a bill to cut paper waste in the US.

Future newspapers and (gulp) magazines may not come to your front door — they may very well be on your home computer screen instead. And they will be written by writers at home, who will then send their electronic copy to editors on the system.

Clothes, food, and gift shopping may all be done from your video screen (a gift-shopping guide is already available on the Source). Door-to-door salesmen may never leave their homes — and you'll be able to reject their pitches by just turning off the screen. The US mail may never get another letter to lose. Bank tellers may never see another human being. Cash — and credit cards — may become obsolete. And "rush hour" may become a dream of a bored traffic cop.

Am I dreaming? Perhaps. But perhaps not. Keith Fuller, president of the AP, said there are two main views of these systems: "One, that electronic delivery is the future knocking at the door; and the other, that electronic delivery to the home is a disaster hunting a victim". But he added: "We're going to find out which".

The Source's Tyl has already made up his mind about the future of home info services: "Not long ago, when you got a hotel room, you looked for a TV set. Soon, you looked for a colour TV. Someday — and it won't be very long from now — you'll look for a computer terminal".

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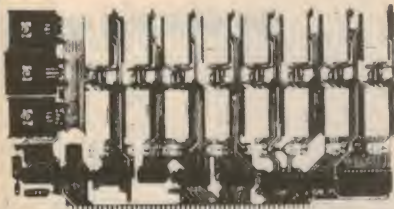
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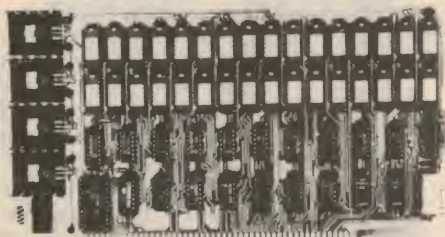
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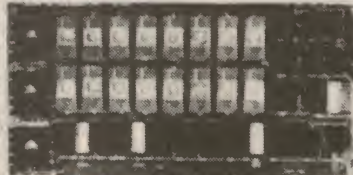
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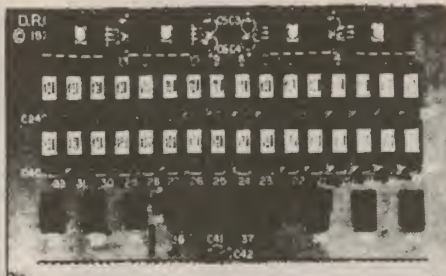
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Probing the stru

with Stanford's new

The US high-energy physics program recently gained a powerful new experimental tool with the completion of the Positron, Electron Project (called PEP). Built at a cost of some \$78 million, the new accelerator will enable scientists to probe deeper into the structure of matter.

by GERALD NOLAN

Situated in leafy, affluent Menlo Park, just north of Palo Alto and well known "Silicon Valley", PEP is the latest addition to the Stanford Linear Acceleration Centre (SLAC) on the Stanford University Campus, California.

Here in the quiet, green Stanford Hills, sub-atomic particles are accelerated to almost the speed of light and smashed into each other with enough force to annihilate both particles completely. The ultimate purpose of this exercise is to seek out the primal constituents of all matter and energy in the universe and how these constituents combine to form matter as we know it.

A joint project of Lawrence Berkeley Laboratory and Stanford University, PEP first circulated electrons on April 21, 1980 and the first electron-positron collisions were seen on May 4, this year.

PEP is a colliding beam storage ring two kilometres in circumference, completed after four years in construction, at a cost of \$78 million. Incidentally, it was completed on budget which, in these days of high inflation, is almost as great a feat as finding the secret of matter.

Collisions are obtained in the PEP ring by injecting electrons and their anti-particles, known as positrons, from SLAC's existing 3.2km linear accelerator so that they circulate in opposite directions. At six points in the ring the beams of electrons and positrons will collide and physicists already have five detectors in place to record what happens as a result of the collisions.

SPEAR: "mother of PEP"

One of the earliest colliding-beam devices was built on the Stanford cam-

pus with the first physics results being obtained in 1965. It quickly became apparent that higher beam energies were required and in April, 1972, after many years of struggling to obtain finance, SPEAR was turned-on to commence what became a dramatically successful program. Compared with PEP, SPEAR is a tiny ring, (approx. 64 metres in diameter) but it was instrumental in the discovery of the "psi" particle for which Professor Burton Richter shared the 1976 Noble Prize for Physics with Professor Samuel C. C. Ting of MIT.

SPEAR I operated a initial energies of 2.5GeV, or 2.5 billion electron volts. An electron volt (eV) is the amount of energy that a particle having a single electric charge (not necessarily an electron) gains when it is accelerated across a potential difference of one volt.

After modifications, beam energies were boosted to 4GeV and the accelerator became known as SPEAR II.

"Higher energies!" the physicists cried, and in 1974 a design proposal for PEP was prepared with the peak energy per beam then foreseen as 15GeV, and with a luminosity of 10^{32} per cm^2 per second. (Luminosity is a measure of the rate at which the beam particles in a storage ring collide with each other.)

Space age PEP probes deeper

Many of the design principles and most of the major components that have been tried and proven over years of operation in SPEAR have been incorporated in PEP. However, it is much more than a larger version of an old model.

Coupled with a literally mind-boggling array of sensors in its truly space-age, computer directed monitoring and con-



LEFT: the 3.2km linear accelerator disappears into the distance from its cluster of experimental halls. The PEP ring is in the foreground, adjacent to the access road.

Structure of matter

\$78 million high-energy accelerator



The Argonne "supermagnet" en route from Chicago to SLAC. The truck had 18 axles, 110 tyres and a length of 43 metres.

trol system, and its tremendous power, PEP will enable experiments to be performed that have previously been impossible. Hopefully it will make possible new insights into the nature of matter and even detect forms of matter never observed before.

Possibly the most technically sophisticated research instrument ever made. PEP looks amazingly simple from inside its eerily echoing tunnel. The "beams", which are really short pulses of high energy particles, are contained in a rectangular section beam tube about 9cm wide. The tube also contains ducts for water cooling and vacuum pumping.

For most of its two kilometre circumference, the beam tube is surrounded by a variety of bending and focusing magnets, vacuum pumps, various sensors and radio frequency booster cavities.

By enabling experimenters to obtain much higher collision energies, or "more bang for a buck", as it is usually phrased, colliding beam storage rings such as PEP are much less expensive for equivalent energies than linear accelerators using stationary targets. This is because the combined energy of the colliding particles goes into the collision rather than

the energy from the moving particle being expended in displacing the rest particle. It is the same reason that a head-on collision with both vehicles travelling at 60km/hr is much worse than hitting a parked car at 60km/hr.

PEP will enable collisions to be produced at up to 36GeV, making it the highest energy electron-positron storage ring in the United States. It is this tremendous energy that enables physicists to probe the successively more difficult layers into the secret heart of matter. It is a process (very) roughly similar to peeling an onion. The dry outer skin almost falls off, but each successive layer requires more effort to remove.

The smaller the particles being sought, the larger the energy and experiment needs to be. This apparent paradox occurs because of the tremendous energy required to release the smaller particles from the inner layers. Then, so that measurements of new particles can be made, already known particles must be filtered out or accounted for in some way. This requires thick layers of lead, iron and concrete and huge magnets to deflect the particles so that their momentum can be measured. In addition there are always the massive con-

crete walls to protect the experimenters and their equipment from stray particles.

Storing beams

As the bunches of electrons and positrons enter the ring they pass from the influence of the injection magnets to that of the ring's magnetic guide field. The two types of guidance needed are:

- Dipole, or bending magnets (a total of 216), to deflect the beams so that they follow an approximately circular path, or orbit, around the machine (remembering of course that the particles cannot "see" the beam tube).

- Quadrupole (4 pole) (a total of 240) magnets focus or "squeeze" the beams in order to overcome their natural tendency to diverge, like the beam of a flashlight.

- Sextupole pole magnet (204 in all) are also used in focusing the beam.

The resulting "bunches" of particles have cross sectional dimensions of 20mm x 30mm, are about 40mm long, contain about 10^9 particles each and circulate at 136,000 times per second!

Because any obstacle in the beam path will result in the eventual dissipation of the beam, an extremely hard vacuum must be maintained in the beam tube.

Stanford's new \$78 million high-energy accelerator

Ideally the vacuum should be about 10^{-17} atmosphere (10^{-14} Torr), but the best that can be achieved by providing a sealed tube with continuous pumping is about 10^{-11} atmosphere (10^{-8} Torr), so the stored beams will gradually dissipate and will require replenishing.

Regardless of how perfect the vacuum and the beam guide-magnets are the beams would not last for more than a fraction of a second without boosting because of *synchrotron radiation*. This always occurs when electrically charged particles are forced by a magnetic field to follow a curved trajectory and may be likened to the sparks from a catherine wheel fire work. More accurately, an observer travelling with the beam would see a radiation pattern like that of a dipole antenna. But, because of the high velocity of the particles, nearly all of the radiated energy is concentrated in the forward lobe, which is also very narrow.

Synchrotron radiation causes three problems:

- Gassing due to radiation dislodging gas molecules from the beam tube walls, giving the appearance of a large steady air-leak. This can only be remedied by pumping harder to maintain the vacuum.
- Heating: At full operation the beams in PEP will radiate energy against the vacuum chamber wall at the rate of 3MW. For this reason a water cooled jacket is built into the beam tube to dissipate the heat.
- Dropping Out: To maintain an angular velocity, particles must be constantly accelerated. If not, each particle will lose about 27MeV on each revolution around the machine. This is a about 1/500th of their total energy and as it occurs 136,000 times per second, the particle would drop out very quickly unless given a sharp kick fairly frequently.

This is achieved through the use of tuned cavities which couple the beam to a powerful source of high frequency radio waves. In addition to overcoming the above losses, RF power is used in PEP to accelerate the particles to much greater energy than the initial injection energy.

RF power system

PEP has three separate RF stations, each about 20 metres long. Each of these three sections is divided into eight subsections, each one of which is further divided into five individual cavities.

RF power flows to the cavities through waveguides from the klystrons located in the shelters on the surface above the beam tunnel. These supply a total RF power of 6MW from twelve 500kW klystrons at a peak RF voltage of 78MV. Some idea of the immensity of the power involved is gained from the fact that each klystron is nearly three metres tall and operates at 63% efficiency (commercially built tubes seldom exceed 40% efficiency). What looks like very high

quality air conditioning trunkings are really waveguides, with a cross section of approximately $50 \times 30\text{cm}$!

The RF (353MHz) power and the beam are synchronised so that the bunches of particles in the beam virtually surf on the radio wave through the tuned cavity.

Beam control

Imagine a situation in which you have several cars travelling at high speed on a steeply banked circular track just wide enough for the cars. If the cars travel too fast, they will fly over the top edge; too slow and they will fall towards the bottom edge.

Greatly simplified, the problem of keeping the cars on the track not by steering, but by varying the tilt of the track and power — is the problem faced in trying to keep the beam in the beam

operators and technicians.

The initial currents were a few microamps with a life time of a few minutes, but over the next few weeks currents were increased to 2mA and life times to a few hours, while the machine physicists embarked on a systematic program to understand the beam dynamics. The information gained during this period was fed into the control system computers, as the desired beam optical conditions from which the computer calculates the appropriate settings of the hardware parameters.

This facility simplifies beam control considerably but it is still difficult and the system requires continuous up-dating to control hundreds of thousands of components around the 2.2km ring. There are just two operators in one small control room!



View of the magnets used to control the beams in the PEP ring tunnel.

tube. The tilt of the track is replaced by the bending magnets and the accelerator by the RF power system.

Add to this the fact that the bunches of electrons are travelling close to the speed of light as are the bunches of positrons in the opposite direction. Then, to fill the ring you have particles being injected at the rate of 360 pulses per second for up to 10 minutes with each pulse 10^{-9} seconds long and containing 1.3×10^9 electrons or 1.3×10^8 positrons.

The problem is no longer simple!

On April 21, 1980 when a circulating electron beam was achieved in the PEP ring for the first time there was great excitement. Having been in the control room until late the night before (Sunday night), I arrived a little late to find only empty champagne bottles and many tired but very happy physicists,

One feature which greatly impressed me was that which enabled the controller to call up a menu of operating panels at his video screen, then, by touching the screen, select the desired panel and operate it by pressing the buttons depicted graphically on the screen. This feature alone saves tens of square metres of hardware that would require six or seven operators.

An additional feature is that the values of the various parameters are shown inside the related button on the screen and change in real-time when the button is touched. This method of representing panels was developed at SLAC and is used in beam control systems throughout the world. The implications for industry — even aircraft control panels — are enormous!

Nowadays, experiments in physics may take five years from first proposal until

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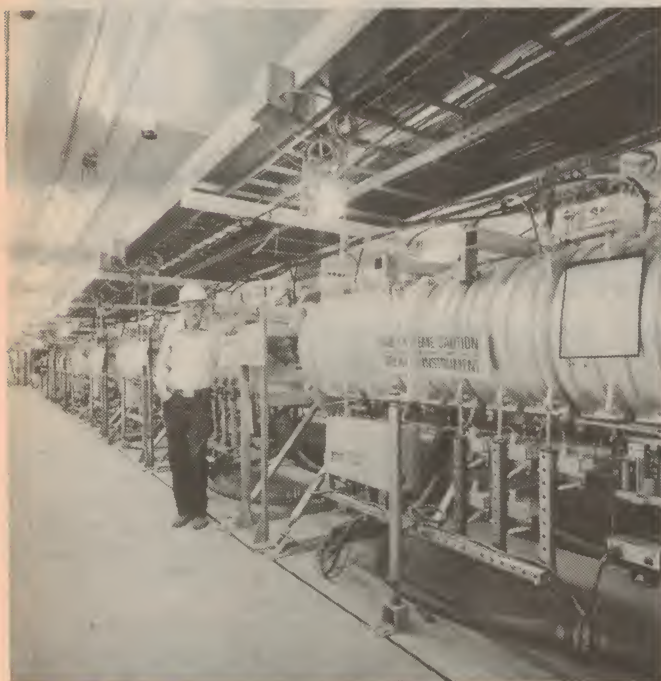
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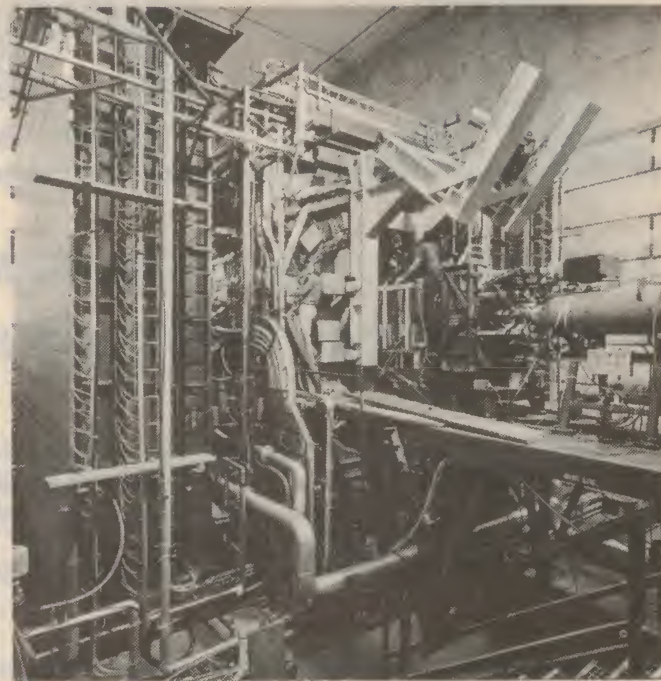
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New accelerator probes the structure of matter



These RF cavities supply energy to keep the particle beams circulating at almost the speed of light. Maximum RF power is 6MW and peak RF voltage is 78MV.



The huge Mk II detector will examine hadron production. The beam enters through the tube at right and passes through a variety of detectors before reaching the collision point.

the time they produce results. In addition to this, they may cost many millions of dollars to construct, set up and man for years of around-the-clock operation, as well as almost invariably having their own powerful computer.

For this reason several universities usually collaborate on a given project, and each experiment may have other experiments "tacked on" to make the maximum use of the beam operating time. The logistics of designing and building the parts of an experiment in five or six different localities thousands of kilometres apart, transporting them to PEP and then having them fit when they are assembled, are mind-boggling.

One dramatic example of this was the transportation of a gigantic superconducting magnet from the Argonne 3.66 metre bubble chamber near Chicago to SLAC by truck. The journey took a year to organise (across seven states) and lasted 17 days with speeds varying from a few km/hr across bridges to 80km/hr across the Utah Salt Flats. It encountered a snowstorm in Wyoming, axle changes, and had to be pulled and pushed over the Sierra Mountains via the Kit Carson Pass. The Prime mover trailer had 18 axles and a total of 110 tyres to carry the 5.6 metre diameter, 107 tonne magnet. The gross weight of the truck was 146.8 tonnes loaded, while overall length was 43 metres!

The experimental program

PEP has six interaction regions where the beams intersect (collide) — at the 2,

4, 6, 8, 10 and 12 o'clock positions — and five detection systems (experiments): Mark II, in interaction region 12, is a general purpose spectrometer and a descendant of the famous Mark I system which discovered the psi particles at SPEAR. Mark II plans to look closely at hadron production over the PEP energy range.

The hadron family consists of well over a hundred particles or "states" that decay, and the search for a simple pattern that may underlie this apparent complexity continues to be one of the central themes in particle-physics research.

The MAC Magnetic Calorimeter (Big Mac) installed in region 4 is designed to look for leptons (particularly muons); search for new particles; measure hadron production rates and take total cross section measurements (ie to account for all particles produced by collisions between the electrons and positrons).

Because muons are able to penetrate deeply into matter, MAC is surrounded by a thick shield of iron to stop everything but the muons. Then detectors are placed outside the shield to count the muons that get through.

The shield around MAC weighs 500 tonnes!

At interaction region 6, data is gathered on apparatus designed to measure an electric charge to within ± 0.04 (an electron is -1.0). This should easily pick up fractionally charged particles and it is hoped that it will detect a

free quark (charge $1/3$ or $2/3$ that of the electron).

If any fractional charge is detected it will "electrify" the world of particle physics research.

The free quark search experiment will eventually be replaced by the High Resolution Spectrometer using the big superconducting magnet from Argonne.

Located in interaction region 8 is the DELCO magnetic detector, which performed well in SPEAR and has been upgraded by the addition of new pole fields and coils for the magnet, a new drift chamber system, a Cerenkov counter with high segmentation and a new vacuum chamber.

Other detectors planned for PEP are the High Resolution Spectrometer and the Time Projection Chamber, which will share region 8 with the α (2 gamma) experiment placed at each end of the TPC to measure particles emerging at low angles to the beam tube.

Experiments using PEP have just started collecting data, yet already new projects are on the drawing board at SLAC and practically every other particle physics research facility in the world. Thousands of millions of dollars of expenditure on research construction, development and experimentation will be made in the next decade.

The benefits to consumer technology are appreciable, but still minute compared with the money spent. Why go on?

Someone probably asked Marconi, Bell and Baird the same question. ☛



FORUM

Conducted by Neville Williams

NEGATIVE ION GENERATORS — A look at the claims, doubts and dangers

Two brief references to negative ion generators in "Information Centre", one each in the January and February issues, turned out to be like lumps of ice floating innocently on the surface of the sea. Underneath we discovered a complete "iceberg", as evidenced by a file which grew spontaneously to centimetre thickness.

In the January issue, a New Zealand reader suggested that we consider describing an air ioniser as a do-it-yourself project. He professed to have had some experience with ionisers and said that they "do seem to live up to some of the claims of their manufacturers".

In a quite separate letter, concerned mainly with the use of oscilloscopes, a reader from St Marys, NSW suggested that, if negative ion generators used circuitry similar to that of TV EHT systems, it should be within the capability of home constructors to build one.

The replies, both very brief, did not seek to debate the merits or otherwise of negative ion generators, as such. But they did draw attention to the fact that such devices could, and often did, produce undesirable quantities of ozone. We added that we have no plans, at present, to tackle a project of that nature.

In fact, both replies were composed by our Technical Editor Leo Simpson and, as often happens, were drawn from his own background knowledge and from what is being said and written in technical circles. There was no emotion and no axe to grind!

We were quite unprepared, therefore, for an immediate and emphatic protest on the basis that our reply had been "thoughtless". That, from a magazine which readers look upon as "a guru in electronics" they (the readers) "expect more than shallow or incorrect statements based on limited expertise in a particular field."

Faced with such an accusation, I took the matter up with a number of contacts in the medical, educational, and engineering fields, and in the CSIRO. All knew about negative ion generators and the kind of claims made for them; a few

had had first-hand contact with them. Not one of those I spoke to were prepared to accept the claims at face value and some dismissed them completely.

Most were apprehensive about the ozone problem, pointing out that ozone is a very common by-product of electrical ion generation.

When I read to them our statement in the January and February issues, there was 100% concurrence. At least, this was reassuring. If we were guilty of carelessness, shallow thinking, etc, we were by no means alone.

But what also emerged from the responses was that companies wishing to promote negative ion generators in Australia face a major problem of credibility at a technical level. It is one thing to publish enthusiastic claims and testimonials; it is quite another to validate them at statistical level.

It was as a result of this round of telephone calls that documents began to



"Captain please . . . can we get in real close, where all the ions are?"

land on my desk. Clearly, various people had begun to think more about the subject and had remembered reports and published items they had seen including, in one case, a complete promotional book on air ion generators from an overseas publisher.

And, from within our own publishing company, came galley proofs of an article which, quite unknown to me, had been prepared for publication in "Vital" magazine. By now, you may have seen it.

From all this, the overall picture became clearer. It seems that the most dedicated support for negative ion generators comes from the continent, notably Hungary, Germany and Russia. Over and above small, personal units for use in homes, offices, and cars, brochures point to large-scale installations in hospitals and public buildings.

In the United States, on the other hand, the authorities, notably the Federal Food and Drug Administration, regard the medical claims for negative ion generators as unproven. At one stage, they banned the devices altogether. It is now permissible to sell them, but only on condition that no claims are made in regard to specific health-giving properties.

So it is that advertisements in US publications typically stress their ability to purify the air you breathe: dust particles deposit on to surfaces rather than ending up as "soot in your lungs"!

They are also likely to stress that their ioniser is safe in respect to ozone: "You should avoid units without stated levels of ozone production . . . (ours) is among the lowest".

The claims in regard to laying dust make some sense: free ions projected into the room atmosphere, may attach themselves to minute dust, pollen and smoke particles. Having thus acquired a minute charge, the particles may be attracted to neutral or oppositely charged surfaces in the room.

One academic told me that he had used a large ioniser to super-clean room air, some years ago, when conducting

experiments with lasers and holograms.

It is reasonable to believe that the deposition of potential airborne irritants may contribute to the well-being of people subject to respiratory problems — but that is where official US acceptance currently stops. Collective academic wisdom there rejects other direct medical claims for negative ions — often in quite uncomplimentary terms.

This same opinion appears to be mirrored in Australia.

Getting down to fundamentals, an ion is a molecule of any substance which has gained or lost an electron — usually on a temporary basis. A molecule which has gained an extra electron is referred to as a negative ion, abbreviated to "negion" in some ion-therapy literature. A molecule which has lost an electron is referred to as a positive ion (or "posion").

By nature, electrons are highly mobile, particularly under the influence of external electrical fields. A lot of electron swapping goes on between molecules so that, in many situations, molecules are constantly becoming "ionised" positively or negatively, only to return immediately afterwards to their normally non-ionised state.

Ions occur naturally in the atmosphere but the theory under examination relies on the idea that everyday environmental situations can produce an unusual number of ions, or a notable lack of them. There may be a predominance of negative ions, or of positive ions, or the two may be in a state of approximate balance.

Protagonists further maintain that plants and people are subtly responsive to the presence of gaseous ions in the atmosphere (type, not always specified) and to the polarity of those ions. In general, it is said, negative ions contribute to human well-being; positive ions have the reverse effect.

Unfortunately for the "cause", much of the prose circulated in support of the negative ion concept is anything but convincing to the technically-minded reader — no matter how much it may impress the public at large.

One manual leads off with a story of how, in 1932, a scientist in a famous laboratory was working alongside an electrostatic generator producing "small ions". On certain days he was alert, happy and able to work efficiently; on other days he was just the opposite. It transpired that his good days coincided with periods when the machine was producing negative ions; his bad days with positive ions.

But what scientist in what "famous" laboratory? Why the vagueness? Credibility suffers at that very first paragraph.

Leafing through "negion" literature, a certain repetitive sameness is evident in the statements and claims from different sources I mention just a few:

- People suffer unpleasant symptoms and tensions when a thunderstorm is building up. But, after a few lightning



"Please don't worry. You'll feel much better once the lightning starts!"

strokes, which help neutralise the excess of tension-building posions, the ion count begins to rise and everyone begins to feel better in the clearer, sweeter air.

- People feel so alive standing by a waterfall, because the rapidly moving water strips electrons from the air molecules, vastly increasing the ion count, both positive and negative.

- Even centuries ago, spraying, splashing fountains in the cities of Europe were known to purify the air and to inhibit the spread of summer epidemics. Ions, of course!

"... they have a certain plausibility, particularly for non-technical readers. In fact, they don't prove a thing."

- A hot shower is stimulating because, as you step out and dry yourself, your positively charged skin attracts millions of negative ions to your body.

- Among the ultimate "nasties" are the so-called "witches winds" which occur in some parts of the world. A warm, upper air mass slides down over the top of cooler air, becoming a hot and dry ground-level wind, often charged with dust and debris from distant areas. The positive ion rises to 10:1 or more; the biochemical defenses of the body are depleted, health suffers, business and administration lags.

And so on, right through to your sex life — and I mean literally!



"Quick. Switch on my thingammy!"

The problem with these statements, and others like them, is that they have a certain plausibility, particularly for non-technical readers. In fact, they don't prove a thing.

It is true that some people are tense and apprehensive when a thunderstorm threatens. Timid souls may rush to draw blinds and cover mirrors. The merely practical — like myself — put the car in the garage as a precaution against heavy hail, and remove the antenna from the TV set rather than risk damage from a lightning discharge. I might even worry about the blocked guttering that I should have cleared last weekend!

When the crisis is over, with no hail and no lightning strikes, with the grass wet, the air cooled, and the blue sky showing through, a sense of relief and even of well-being is not altogether surprising — with or without negative ions!

Again, the environment of waterfalls, and even of artificial fountains is usually conducive to mental relaxation.

The same goes for a warm shower and the opportunity to shed the perspiration, the grime and the grass clippings. The role of negative ions is not quite so self-evident.

And as for hot, dusty winds, that parch and maybe irritate the throat and grime the body, I accept their ability to sap one's energy, without having to blame positive ions!

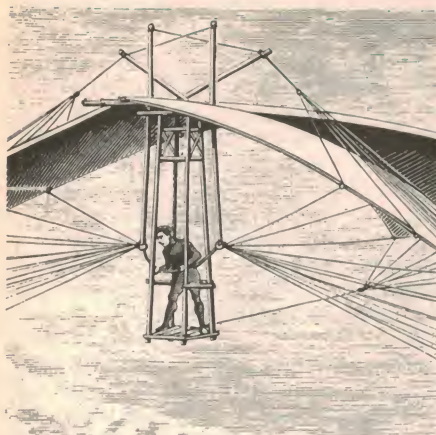
It is not exaggerating to say that one

could add to this literally pages of published claims and speculation reaching right back into folklore — even to moon madness. Dracula's career might have been much less spectacular, if only someone had sneaked an ion generator into his bedroom to counter these moon-induced positive ion showers from the ionosphere!

As distinct from these rather superficial and sometimes fanciful observations, air ions have been the subject of considerable deliberate research, some of which was mentioned in an article by Assistant Editor Greg Swain, in this magazine, in July 1978: "Are Negative Ions Good For You?"

In particular, Greg Swain mentioned the work of Dr Albert Kruger who, for more than 20 years, conducted research at the Air Ion Laboratory at the University of California. Papers by Dr Kruger feature large in the bibliography of articles supporting the negative ion concept.

The underlying hypothesis is that air ion concentrations affect the blood level of serotonin, a powerful neurohormone. The hormone occurs in considerable quantities in the lower midbrain, where it plays an important role in processes such as sleep, the transmission of nerve impulses, and the development of mood.



"I must keep clear of the ozone layer!"

Research is said to indicate that negative ions lower, while positive ions raise, blood levels of serotonin. Reduction of serotonin levels in the brain by the negative ions has a tranquillising action, reducing tensions, generating a feeling of well-being, etc.

Various other physiological effects or mechanisms have been considered or claimed for ions, either in addition to the serotonin hypothesis, or in place of it!

One fairly restrained set of claims gives most of the credit to negative ions of oxygen. By reducing the irritant hormone serotonin, some relief can be expected from discomforts like nervousness, fatigue, migraines, dizziness, diarrhoea and depression. Improved breathing may bring about "a better disposition in humans and animals ... the general well being is improved".

At the other extreme, I came across a list of positive ion associated problems reported in the literature of air ion generators. While the Author would not vouch for more than a few of them, they added up to an imposing list for anyone wishing to be impressed. There were 57 of them in all, arranged in alphabetical order; they started with Allergy and finished with Wounds-healing.

One could be excused for a certain scepticism, as for the exaggerated claims of many and varied fringer-medics.

But among the documents which landed on my desk, as aforesaid, were a couple of items published recently in "Science" magazine, produced weekly by American Association for the Advancement of Science, and based in Washington.

In Vol. 210, October 3 1980, Marjorie Sun commented on the renewed interest in the USA of negative ion generators. She says:

"Believers swear that the generator is a panacea for everything from surliness to insomnia but they concede that the effects may be psychosomatic. Scientific evidence as to the power of the ioniser is scattered and uneven."

She goes on to repeat the kind of claims made for negative ion generators, gives some instances of their use and refers to some of the scientific work that has been done.

She also quotes a now-retired Albert Kruger as saying: "We don't know how neurotransmitters respond to negative ions" and adds that "Kruger knows of no explanation why the ions can kill or inhibit growth of bacteria".

But, even though Marjorie Sun took a fairly ambivalent posture, a correspondent in a subsequent issue was plainly very upset by the mere publicity for negative ion generators. His name: Melvin W. First, Harvard Air Cleaning Laboratory, Department of Environmental Health Sciences, School of Public Health, Harvard University Boston, USA.

First pointed out that ionic or electrostatic dust precipitation had been used in air conditioning ducts for over 60 years and that it worked equally well with either negative or positive ions. Ion discharge into an indoor environment for mood control was quite another thing.

First says that critics of the negative ion concept are invariably branded by ion promoters as stubbornly biased. Significantly, however, investigators do typically agree that "pro-ion" research has lacked adequate structuring, instrumentation and control of the many interacting variables. Even Kruger feels that some of his findings have been interpreted beyond what he, himself, is disposed to accept.

First also draws attention to the ozone problem and concludes: "Is it any wonder that the claims quoted in Sun's article raise the hackles of scientists who have been trying for decades to counter the exploitation of mysterious air cleaning devices that are promoted with testimonials by the gullible?"

Strong Stuff!

When we drew Mr First's letter to the attention of a local distributor for negative ion generators, it did not cut much ice. The said distributor had



"There's no doubt about it. Nature has plenty of ions in the tire!"

already laid the blame for the US situation at the feet of the American medical establishment. He simply went the further step of questioning US opinion generally, as being behind the times in this type of research.

"Who is Mr First to question the findings and lifetime research of say Prof Dr Kruger or of the late Dr Kornbleuh ... as well as a long list of others higher qualified than himself?"

I don't know, except to say the Melvin First is not without some relevant accreditation, or substantial support from elsewhere.

With so many voices raised for and against the negative ion proposition, it becomes an electronic version of many other major medical and environmental debates. A mere technical journalist cannot hope to do more than we did back in July 1978: explain what it's all about and proceed to much the same conclusion:

"We're not committing ourselves one way or the other — at least until a lot more research has been done."

But don't hold your breath; a definitive conclusion is not likely to be reached tomorrow, or next week or next month.

As one medico explained to me, the conduct of statistically valid, large-scale placebo tests is an enormous undertaking.

If one of the pro-ion authors is right, it will be tougher even than that. According to this writer, sensitivity to ion effects is itself subject to a distribution curve. Fifty per cent of the population has moderate sensitivity to the ion environment; 20% to either side are respectively much more or much less sensitive; the remaining 5% on either side are respectively acutely sensitive or notably insensitive.

A few people, in certain categories, says the same author, may even appear to react more favourably to positive ions than to negative ions!

So the argument goes on, and seems likely to continue into the foreseeable future: whether negative ion therapy is beneficial and, if so, in what ways? What concentration of negative ions is acceptable and over what periods? In what everyday environments are negative ion generators advisable, unnecessary or even undesirable ... and so on?

WHAT ABOUT OZONE?

However, the problem of ozone generation, to which we drew attention in Jan/Feb, is not quite so vague.

Ozone, a three-atom molecular form of oxygen, has long been credited with invigorating properties and this impression still comes through in some older dictionaries. Even where the basic definition may be strictly factual, one popular usage may still be acknowledged: to reinforce the idea of invigorating, bracing air, as at the seaside.

The popular misconception is strengthened by the long-time practice

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of releasing ozone into tunnels to "purify" the atmosphere. The most logical justification is that ozone oxidises pollutant gas molecules in the confined atmosphere, turning them into a less noxious form.

As well, the ozone tends to sterilise the air, as in some public buildings, by killing off bacteria.

However, it is now widely accepted that, in unnatural quantities, ozone can be toxic to more than just bacteria. It is even said to have carcinogenic properties. (What hasn't, these days?)

On the basis of figures to hand, the natural concentration of ozone in surface air ranges up to about 50 parts per hundred million or 0.5ppm. The Australian Commonwealth Department of Health recommends that no device add to this more than 0.1ppm, referenced to an 8-hour working day.

In the context of negative ion generators, which may well be used in offices or homes for protracted periods, it would seem logical to take full note of this requirement. Particularly would this be the case in small rooms with limited ventilation.

According to a couple of spokesmen within the industry, there are about 10 different negative ion generators currently on sale around Australia. Both quite independently suggested that about half the number could be dubious in terms of ozone emission. To verify this impression, however one would need to undertake quite lengthy investigation.

That is not our role, of course. It is the responsibility of manufacturers and/or distributors to ensure that their products conform to local requirements, whether by local testing or the validation of overseas documents with the appropriate authority.

I do know that we came across one unit which has been tested and certified in Australia. Ozone output was shown to be less than one part per hundred million, or below one-tenth of the Health Department figure. In these circumstances, no odour is evident in the room, although a keen-nosed observer may detect it right at the output ports.

We also sighted a report on another unit which failed badly, with a measured ozone output of 0.7ppm — seven times the recommended figure, and 70 times the unit referred to above. For many people, exposed to such a device, the most obvious effects would probably be a funny smell and a very un-funny headache!

What about the remaining seven or eight units? Adjectives asides, and negative ions notwithstanding, how much potentially toxic ozone would they likely release into an office, study or bedroom?

The answer might be "very little".

But before buying one, I'd need to be assured in quantitative terms, by a distributor's warranty acceptable to our Australian Department of Health. It should not be too much to ask!

50 & 25 YEARS AGO



"We understand that more than a spot of bother will plop into Eastern Europe when Russia's 100 kilowatt relay station opens at Bogorodussja, disseminating propaganda throughout neighbouring countries. The most bothered person, in our opinion, will be the announcer."

"Sir Hubert Wilkins is taking a telephony transmitter with him in his submarine to the North Pole, and when the submarine comes to the surface he proposes to transmit accounts of the expedition's experiences to points in the United States. If he does come to the surface."

"The disappearance of the hurdy—gurdy man from England, Europe, and America has been attributed to broadcasting; but we refuse to be associated with a statement so unkind. Indeed, the numerous musicians who now perform in our streets are surely evidence that, in Australia at least,

broadcasting has not yet effaced this kind of competition."

Radio enthusiasts, and others who are not so conversant with the theory of radio, may have been interested to read a cable which was recently received from England, regarding a so-called "Magic Ring".

The cable stated that short-wave wireless could be applied to prevent sea collision: that a ship will shortly be able to put a wireless belt around itself, which other ships will not be able to enter, without realising the proximity of the vessel. Declared Marchese Marconi, in an interview: "The short-wave is the most important thing in wireless. It has revolutionised everything. I hardly dare to think what the future may hold as the result of experiments in this branch of radio science. Short-waves cannot become mixed with other waves. Nobody can tune in, as the message will go only where intended. We should thus also be able to employ short-waves for house-to-house communications."

"A Paris station was forced to pay 25 francs damages for infringement of copyright to the heirs of Victor Hugo, who are now less miserable."



"Earlier this year, a Detroit safety engineer built a device which uses radar to automatically operate the power brakes of a vehicle when anything appears in its path. A radar unit is mounted below the front grilles (a similar device can be mounted on the rear for reversing) and projects a pair of beams ahead. The faster the car goes, the further ahead the beams are thrown. As soon as one is interrupted, a trip mechanism applies the brakes until either the car stops or the obstacle is removed.

"One American car manufacturer is said to be so interested in the experiments that his engineers are working frantically to perfect the system in time to make an appearance on the 1957 models.

"And what of the future?

Many experts predict that in due course the motor cars on the major highways will 'come in' on an electronic beam just as commercial aircraft are guided into the international airports."

"Every year that goes by sees an increase in the applications of radioactivity. With it comes the need to guard against dangerous but unsuspected radiation effects. Warning devices, which are currently in use, apply principles which range from the very old to the very new.

"A Geiger counter made up to wear around the neck. (Photograph shows attractive model elegantly dressed and wearing geiger counter around neck). It weighs about three pounds and operates from a couple of torch batteries. The meter pointer indicates a green, a yellow or a red portion of the scale, according to the amount of radiation present at any time."

"Despite the high cost, both of receivers and program material, colour television still continues to make progress in the US. NBC has recently announced the inauguration of the world's first all-colour television station.

"The pioneer station is WNBQ, the NBC-owned station in Chicago, with studios in the Merchandise Mart."

The WNBQ conversion is one phase of a \$12 million dollar plan announced by NBC to expand colour television facilities in New York, Chicago, and Hollywood."

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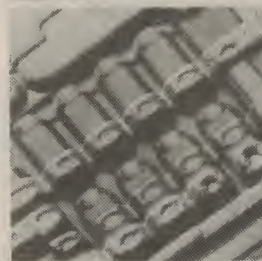
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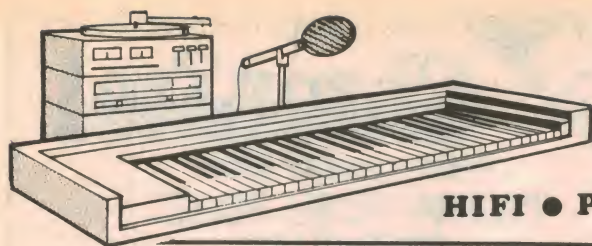
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AUDIO ~ VIDEO ELECTRONICS

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LAS VEGAS CES: There today, here tomorrow!

In this first-hand report from the Las Vegas consumer electronics show. George Tillet emphasises the video wave that is currently sweeping the USA. Large-screen receivers, video discs and satellite television systems were all highly visible, along with the usual array of new, advanced technology hifi audio.

by **GEORGE TILLET**

(Special correspondent in the USA for "Electronics Australia" magazine)

In the terms of support, attendance at the Winter CES in Las Vegas was a record 59,000 and I was pleased to find a positive feeling of optimism among the exhibitors, instead of the rather depressing air of uncertainty which pervaded last year's Show.

In the main, this had to do with the impending change in government but another cause was the fantastic boom in video products, which was reflected in the increasing number of video magazines.

Video discs were predictably centres of attraction and all three systems were being demonstrated by various manufacturers.

As most EA readers will know, the systems are not compatible and the situation is not unlike the great quadraphonic fiasco, because each system is backed by powerful interests.

For example, RCA (who have just introduced their disc player) have access to the large CBS repertoire and users of Pioneer type laser systems are catered for by Columbia, MCA and other Hollywood groups.

Although the RCA system uses a stylus groove (described by one critic as "a giant step backwards") the picture, as demonstrated was quite comparable with its competitors and the price of below \$500 makes it very attractive. The first models released only have a single audio channel but a stereo version and an adapter will be introduced later this year.

This will give you some idea of the size of those micro-grooves: they are 38 times thinner than those on ordinary audio records and the stylus would travel the equivalent of 40km for a two-hour program!

Projection TV is slowly gaining in popularity and there were a number of new models to be seen. Advent had a one-piece model in the form of a handsome coffee table: open the top and there's the screen! Picture size is 50 inches and — here's a sign of the times — there are input sockets for video games, VCRs and videodiscs.

MINIATURE TV, MULTI-SCREENS

At the other extreme, Toshiba were showing three "pocket TV sets" measuring under 18cm long, 8cm wide and only 1.8cm deep. The liquid crystal matrix screen size is about 5cm, while all three models have a built-in zoom feature to double the image size at the centre.

Another interesting TV came from Sanyo who had a fairly conventional 48cm table model with two extra 12cm screens. These could be tuned to different channels or used with an optional camera for security monitoring.

Several new VCRs were to be seen and the accent seems to be on portables such as the JVC 220 which weighs less than 5kg. A few weeks ago, Technicolor entered the market with an even lighter model — around 3kg — which uses 6.3mm tape instead of 12.7mm. It measures 25cm square. The cassettes, which are made by Fuji, are slightly larger than audio cassettes, but play for one side only. It is stated that a combined VCR-camera version will be introduced later this year.

Last year, only one manufacturer of Earth Stations for satellite TV reception was at the Show but, this year, there at least six of these enterprising companies represented. The various parabolic dish antennas were on display outside the convention hall. They ranged from large four-tonne reinforced metal affairs to wire and fibreglass assemblies that looked like attempts at modern art, with prices ranging from \$US3000 to over \$12,000 for complete installations.

The programs they are designed to pick up come mainly from RCA's Satcom 1 which is 40,000km up and radiates on 24



Bernie Mitchell, President of Advent, poses beside a hand-some table, complete with floral arrangement and refreshments. But tilt the top and the table becomes a complete, self-contained, 3-tube projection TV unit.

frequencies between 3.7 to 4.3GHz. The programs are beamed up to the satellites (on a different frequency, called the uplink) for use by cable TV stations who pay a fee and so they are somewhat unhappy about people putting up dish antennas in their backyard and looking at programs for free!

Makers of Earth Stations say (with tongue in cheek) that the airways are public and anyone should be able to use them. So far, the legality hasn't been tested.

In the meantime, the FCC has granted permission for 20 more domestic satellites — mostly for business purposes. Some will be used for cable TV which is expanding rapidly, possibly because it provides programs not seen on ordinary TV. These include Broadway Shows, 24-hour sports programs, continuous newscasts, X-rated movies, and a "Shop-at-Home" service with special price reductions for subscribers.

HIFI AUDIO EQUIPMENT

In the field of hifi audio, several cassette decks were to be seen with the Dolby HX (headroom extender) feature but the big news was the introduction of Dolby-C. In effect, this consists of two "B" circuits in series, plus an extra circuit to improve high frequency headroom. Noise reduction is 20dB and it is obviously Dolby's answer to HiCom, dbx and other systems that have appeared since the -B system was introduced.



"Nice to come home to" would seem to be the theme for this picture showing the Quasar video disc player. It uses the VHD grooveless capacitive system. ▲

At the Press demonstration, Ray Dolby stated that 20dB of noise reduction was the maximum that could be achieved before undesirable side effects occurred. Thus, it would seem unlikely that we will see a Dolby-D system — which is probably just as well! Some deck manufacturers will feature HX as well as -C but all will have a switch position for -B as there are many thousands of -B cassettes out there.

The dbx company were demonstrating some new dbx cassettes and comparing them with open-reel tapes played by a top quality machine; the differences were really quite small. It was emphasised that the dbx system works at low frequencies too. Thus, a low frequency signal could not trigger the gain circuit to bring in background hiss.

Some months ago, JVC introduced a cassette deck with BEST which, translated means Bias, Equalization and Sensitivity Tuning all of which describes a built-in microcomputer that performs those functions automatically.

Now, Akai have a similar model, the GX-95, which also has a monitor head, full logic controls, electronic tape counter, two



▲ Already massively involved with satellite television and its CED "Selectavision" system, RCA has entered the projection TV market with this attractively styled unit.

24-section bar-graphs and two servo-controlled DC motors. There is also a built-in timer and an optional remote control unit — a far cry indeed from the original Philips deck circa about 1950!

Sansui's new D-550M has what is called a "Dyna-Scrape filter" to reduce modulation noise caused by irregular tape motion.

Dual's top model features a one-step record ready system with open access to the tape compartment. An infrared photo switch stops the tape when a finger moves to the cassette.

But perhaps the most interesting deck comes from Op-tonica: it has two separate compartments, one for playback and the other for record. Not only does this provide editing and dubbing facilities but it allows the heads to be designed for optimum performance. Thus, the record head has a large gap of three microns and the playback head is only 0.8

▼ The display from National Panasonic emphasises an aspect of video disc quite distinct from entertainment — its use in professional and educational situations.



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AUDIO-VISUAL ELECTRONICS — Cont

micron. There is a special dubbing level control and a one-touch sync control so both tapes can start together.

Although the great majority of the medium and high-priced decks had provision for metal tapes, few people tend to use them — judging from the sales figures. One reason has to do with the relatively high price and then again, the audible improvement is not all that great with many decks. Moreover, the new premium formulations like TDK's SAX series, which use double layers of oxides, are not too far behind metal — especially if Dolby HX is used.

It is estimated that there are now over 400 loudspeaker manufacturers in America: fortunately, they were not all at the Show but there were quite a few and space will not allow anything like a complete report.

The best I can do is to mention some of the most interesting, starting with one of the higher priced models, the Cosmostatic. This model stands 1.5m high and has 11 electrostatic panels for the high frequencies. Eight of these are arranged in a circle, while three fire slightly upwards, so the array is umbrella-shaped. A 37mm dome smooths the transition frequencies and the bass is handled by four 150mm woofers plus two 250mm passive radiators. The electrostatic elements are fed from a built-in matching amplifier capable of peak outputs as high as 1200 watts. Price: \$3600 a pair!



▲ The VIETA B-10,000 loudspeaker from Spain uses four treble and four mid-range drivers mounted alternatively in a circular array, plus a bass driver in the main enclosure. Price is \$3500 per pair.

◀ "A giant step backwards" say the knockers of RCA's "Selectavision" but picture quality is good and the price probably unbeatable.

◀ MCA/Mitsubishi's X-10 Interplay System combines AM/FM stereo radio with integrated amplifier, cassette deck and a vertical, linear tracking phono player.

▶ Strictly utilitarian and portable, this "PRO-90" system from Wharfedale is intended for discos, sound reinforcement, etc.



Dayton-Wright were demonstrating their new electrostatic full-range systems which, like previous models, use an inert gas to prevent corona and increase efficiency. As you might expect, price of these systems — which are made in Canada — is quite steep, at about \$5000 a pair.

Another Canadian company, Sound Dynamics, were showing a prototype ribbon tweeter having a corrugated diaphragm measuring 200 by 25mm which was edge-damped with urethane foam. Response was claimed to be flat from 400Hz to 20kHz with a high power handling capacity.

Infinity's new Reference Standard II is not as large as the wardrobe-size Reference 1, as it stands only 122cm high. It is a 4-way system with two 250mm bass drivers, three 125mm midrange speakers and two EMIT planar tweeters. Radiation is di-polar and, yes it is a four-way system because the bass drivers operate in different frequency bands. Both use the

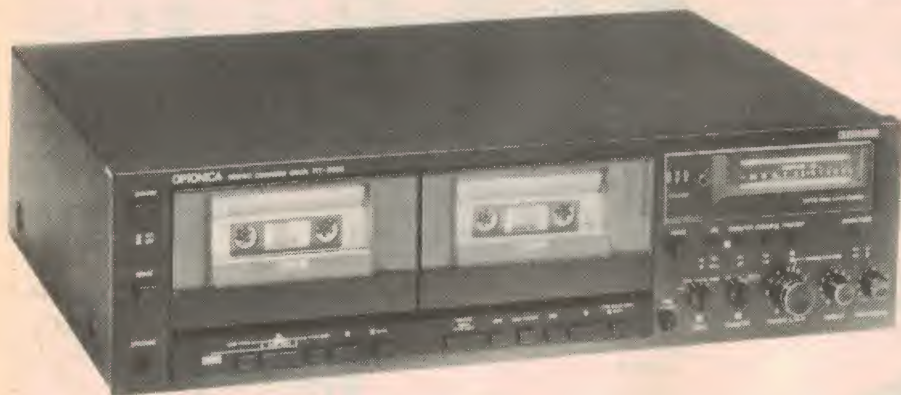
Watkins dual voice coils.

JBL were demonstrating their newly released Model L 112 bookshelf system which uses a 300mm bass driver, a 125mm midrange unit and a special 25mm super-tweeter. Sixteen of these systems were stacked up on each side so what we had was pulsating wall of sound – most impressive!

Koss added two more speaker systems



Sansui's D-550M metal-ready cassette deck combines direct drive with their "Tension Servo Mechanism" and "Dynascope Filter", intended to achieve the smoothest possible tape traverse. The deck is available in matte black finish or brushed aluminium.



Sharp/Optonica's RT-6605 deck has two cassette compartments, one optimised for recording, the other for playback. It can fulfill the role of a normal domestic deck but has the further feature of being able to dub cassettes, with movement of the source tape and copy tape precisely synchronised.

to the range: Model 210 and Model M-80 which is called the "Dynamite". It measures 300mm by 140mm square and it has a pair of 114mm woofers with a 25mm dome tweeter. The other model, the 210 is a floor-standing system with a 300mm bass driver, a 125mm midrange speaker and dual 37mm tweeters which are angled to give a wide dispersion.

Latest addition to the growing number of SLT (Straight Line Tracking) turntables came from Benjamin but, unlike its competitors, it boasted a front loading arrangement which allowed the front section to be pulled out. A nice idea where space is limited.

Mitsubishi introduced a vertical SLT model some months ago but now they have combined it with a cassette-receiver to form a complete audio system with optional loudspeakers. The electronics are built into the base so the

whole unit is only 58cm high, 47cm wide and just over 23mm deep.

S-shaped tonearms are gradually being superseded by straight types, in fact, the latter are now as scarce as hen's teeth! Most manufacturers are stressing the virtues of low-mass, although few can seriously compete with Dual's eight grams. Carbon fibre headshells are quite common, while several models were to be seen with special insulating feet to reduce acoustic feedback. For example, Onkyo has developed a "triple-insulated" mounting foot while all Dual models are fitted with "tuneable" feet which can be adjusted to suit various conditions.

This year, the emphasis is still on facilities and low distortion for amplifiers, rather than on power output – and the same applies to receivers.

Sansui introduced another amplifier

which uses the "feed-forward" output circuit instead of a feedback loop to reduce distortion. This is the AU-D9 and it has a power rating of 95 watts per channel at less than 0.005% THD.

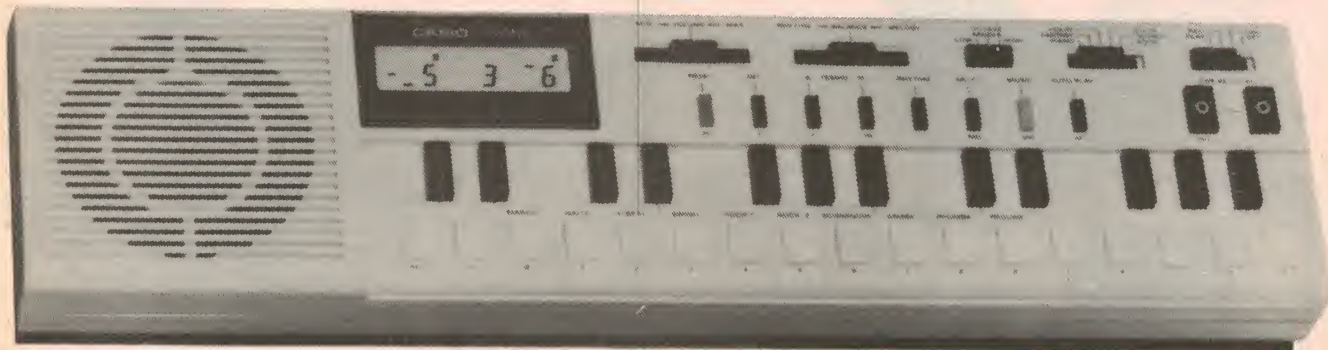
Many amplifiers now use a "Super A" or "Zero Switching" output circuit as mentioned previously in these pages. A typical example is JVC's A-X7 which carries a 90-watt rating with less than 0.003% THD. Transient intermodulation (TIM) is claimed to be "non-existent".

DIFFERENT APPROACH

Micro-components are still quite popular, although I don't believe that sales have been as high as expected. Most of these components are fairly sophisticated versions of larger models with all kinds of "bells and whistles" and I must say they are very attractive, with considerable eye appeal.

However, the Advent company believe that these items are not really meeting a need, so they have taken a different approach with a new low priced series called "Advent Response". What they have done is to use a down-to-earth, "no frills" concept to "meet the demands of those who want good music with the minimum equipment".

The basic receiver has no displays, fancy tuning devices, coloured lights or banks of pushbuttons and is in the form of a small cube with a simple tuning dial. It costs only \$140 with a



Casio's VL-TONE has a keyboard which allows the user to play and store up to 100 notes, which it will then play back in selectable pitches and voices, with or without selectable pre-

set rhythms. The final sound can be heard through headphones or internal loudspeaker, or via an external amplifier. For good measure, the instrument will double as a calculator!

If you haven't got a pair of these, you've never really heard your hi-fi.



HD 400
High quality, low cost dynamic — as used in first class by major international airlines. Featherweight 80g. Frequency response 20-18,000 Hz.



HD 420
Voted the top headphones in the USA for quality and price, by a major American consumer group. Light 129g. Frequency response 18-20,000 Hz.

You could have a superb, multi-thousand dollar hi-fi outfit. But until you've heard it through a pair of top quality earphones, like Sennheiser's, you won't appreciate how good the system really is.

You see, no matter how good your speakers are, their sound is affected by their surroundings. Curtains and furniture deaden high frequencies. Positioning and distance affect the base end. Outside noise and ambience interfere with your listening.

But with a pair of Sennheisers, the sound is delivered right to your ears, with no interference. And the supreme quality of Sennheiser's research, design, and engineering, ensures that the sound you hear is reproduced as perfectly as is possible at the present state of the art. You'll hear your system's sound—the depth, the stereo, the subtlety of the instrumentation—like never before.

Sennheiser's quality has a further dimension—comfort. The weight, the grip, the feel, have all been calculated to cut down headphone fatigue. This is why whenever you see a pro at work—a disc jockey, a recording artist—almost invariably he'll be wearing Sennheisers.

But don't take our word for it, go to your hi-fi dealer and listen to a set of Sennheisers. Then take a pair home, and rediscover your own hi-fi.

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Electrostatic headphones. Better frequency response and higher output level than ever before. Not cheap. But if you're a perfectionist, these are your headphones. Frequency response 16-22,000 Hz.

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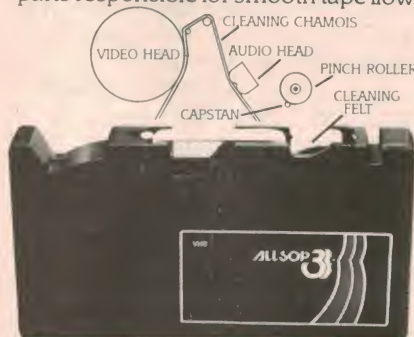


You're watching your favorite superstars on your video cassette recorder. Whammo! Stripes across the screen... distortion... noise. Now, in addition to the hundreds of dollars you paid for this premium piece of equipment, you also face a hefty repair bill.

Not necessarily. Chances are you can stop distortion problems in 5 seconds flat with the revolutionary new VCR cleaner called ALLSOP 3.

ALLSOP 3 VCR CLEANER thoroughly removes oxides and other pollutants from your VCR's audio and video

heads, capstan and pinch roller—the parts responsible for smooth tape flow



and top performance.

Simply moisten the ALLSOP 3 cleaning cassette with special formula ALLSOP 3 VCR cleaning solution. Insert into your deck as you would a regular video tape. Press the "play" button and a non-abrasive felt pad and ultra-soft chamois go to work, one cleaning the capstan and pinch roller, the other cleaning the heads. The entire ALLSOP 3 cleaning cycle takes just five seconds, then shuts off automatically.

Now turn on the stars and see your money's worth.

LOOK FOR ALLSOP 3 WHEREVER VIDEO PRODUCTS ARE SOLD.

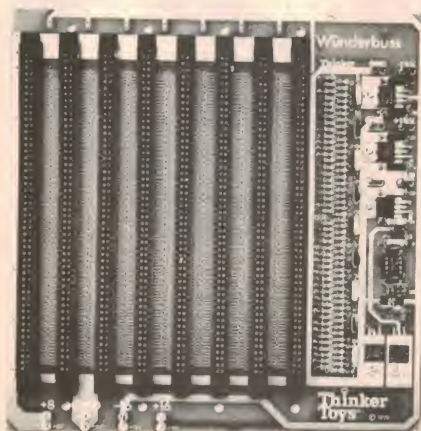
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See previous ads in EA and ETI.

matching loudspeaker while the stereo version is rather larger and it goes for \$290 with two loudspeakers.

It certainly seems to make a lot of sense — especially for those with small rooms (and budgets) and I have an idea that something of the kind would be welcome in Australia.

ALSO NOTED:

A musical instrument that lets you record up to 100 musical notes and play them back in any one of five voices: piano, guitar, violin etc? And let you work out your tax figures? Yes, there is such an instrument: Casio's VL-Tone, a digital synthesizer combined with a calculator! It measures 300 by 75 by just over 25mm and it can be used with earphones or plugged into an amplifier. Once you have recorded a tune, you can blend in any one of 10 background rhythms such as march, waltz, samba or swing and you can adjust the output up or down an octave. Price is only \$70... Sharp had a small print-out calculator with a difference: it has a 23-letter keyboard so it can function as a mini-typewriter... Toshiba were demonstrating a tuner which actually announces the station's call letters! It accepts and stores call letters as verbally instructed via a microphone. As the station's frequency is displayed, a voice announces the call sign... Outside the Show, several cars were demonstrating audio equipment. One had a pair of 38cm woofers squeezed under the rear seat plus at least 12 smaller ones at the front, all fed from a 1000 watt amp. A red notice inside said: Danger, 140dB! Casio had an electronic cash register claimed to be the only cash register in the world to play "Greensleeves when the drawer is opened" I bet this is not going to be the cashier's favourite tune after a few weeks!

IN BRIEF...

RCA's CED video disc system has apparently sprouted some additional and unexpected features for what was supposed to be a basic, grooved system. New prototype players include pause, rapid forward and reverse visual search, and rapid forward and reverse access. The search mode is at 10 times normal speed, during which a good quality picture is displayed. RCA's first disc catalogue is said to contain 150 titles.

K.G.C. MAGNETIC TAPE PTY LTD, of 40 Applebee St, St Peters, NSW, have purchased additional cassette duplicating and loading machines, plus other specialised equipment, which will increase by 50% their potential output of pre-recorded audio cassettes. According to General Manager Bill Gordon, the company is also planning to expand its video duplicating facilities, which will necessitate new plant and larger premises to house it. The expansion

Two lucky EA readers

CAN WIN

this magnificent Marantz SD 5010
cassette deck ... retail value \$359



or this stylish Marantz ST 510
AM/FM tuner ... retail value \$349



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19 Chard Rd, Brookvale, NSW 2100

Phone (02) 939 1900

CONDITIONS AND WHAT TO DO...

CUT OUT this two-column panel with the crossword and clues on the back. Alternatively, in states where this requirement is illegal, make a clear, same-size photostat copy of the panel containing the crossword, clues and entry form and use this for your entry.

COMPLETE the crossword overleaf in clearly readable block letters. The correct solution will be as supplied by the designer of the crossword.

RETURN the panel, uncut, containing your solution, the clues and the completed entry form, so as to reach our editorial office not later than 5pm on June 30, 1981.

POSTAL ADDRESS: Endorse your envelope Marantz Competition and post to Electronics

Australia, PO Box 163, Beaconsfield 2014. Our street address: 57 Regent St, Sydney (near Central Railway).

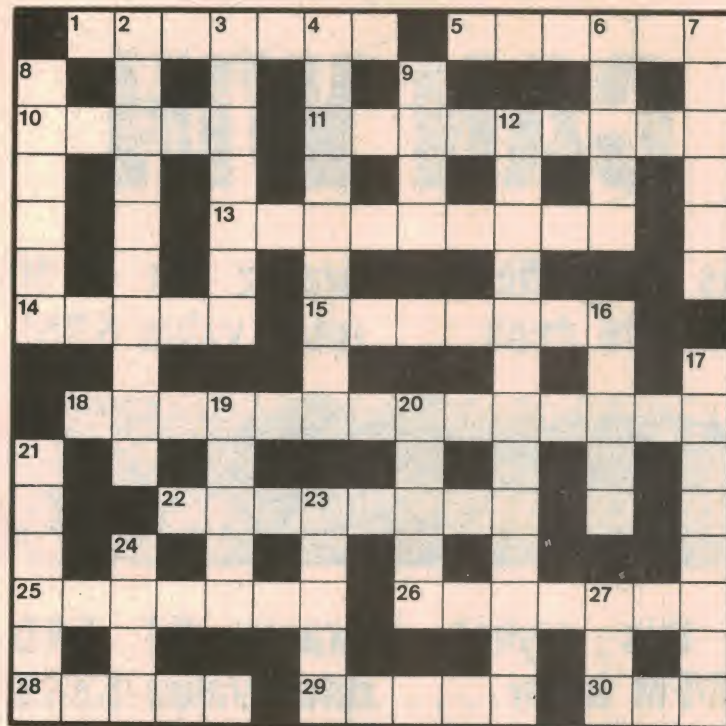
JUDGING will be supervised by Neville Williams, Editor-in-Chief of Electronics Australia. His decision will be final and no correspondence will be entered into.

THE WINNERS will be the first two correct entries drawn at random from a suitable container. Each successful entrant may select either a cassette deck or a tuner. (Permit number TC 81-95.) Individual entrants are eligible for one prize only.

THE PRIZES will be supplied to the winners, by arrangement, by Marantz (Aust) Pty Ltd, 19 Chard Rd, Brookvale 2100.

See overleaf

Marantz competition crossword



ACROSS

1. Manufacturer of top-quality hi-fi systems. (7)
5. Devices which convert AC to DC. (6)
10. Cone shape — or a person who records. (5)
11. Capturing a sound. (9)
13. To reduce the magnitude of signals. (9)
14. Rotates about an axis. (5)
15. Components in loudspeaker enclosures. (7)
18. Modern system of wiring on a board. (7,7)
22. Process of reducing some signal amplitude peaks. (8)
25. Position of a linear control for increased loudness. (5,2)
26. Semiconductor element. (7)
28. Tendency for a tuner to move from optimum tuning. (5)
29. A component needed for AM/FM radio reception. (5)
30. An organ for hearing hi-fi. (3)
3. Conductors used to receive radio signals. (7)
4. Rotating support for a record being played. (9)
6. Electrical energy fed into a loudspeaker. (5)
7. Information for an electronic system. (6)
8. Part of a pick-up. (6)
9. To look quickly through the programs. (4)
12. Description of a truly constant frequency. (6,7)
16. The sensation of vibration perceived by the ear. (5)
17. The kitchen equivalent of a filter. (8)
19. Unwanted random sound. (5)
20. Moving parts in some loudspeakers. (5)
21. Removed the recording from the tape. (6)
23. The source signal for a hi-fi unit. (5)
24. Sound of above-average fidelity. (2,2)
27. A guide for correct positioning. (3)

DOWN

2. Items of hi-fi equipment which strengthen signals. (10)

DO NOT DETACH

ENTRY FORM Marantz/Electronics Australia contest

Please read carefully the conditions and instructions (previous page)

NAME

ADDRESS

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follows acquisition of the Company by The Rigby Group, which has substantial interests in book publishing, films and the music industry.

SANYO ELECTRIC COMPANY, through its subsidiary Tokyo Sanyo Electric Co, startled the Japanese electronics industry by announcing that it would be commencing manufacture of VHS type video cassette recorders. Sanyo, along with Sony and Toshiba, has long been a champion of the Beta system. The new decks will not carry the Sanyo name but will be supplied through overseas private-label companies. Reportedly, one of the companies involved is Sears Roebuck in the USA, who have thus far carried only Beta format decks.

END TO 405-LINE ERA: When BBC high-definition television was officially launched in November, 1936, the choice of a 405-line standard was a forward-looking investment in the future. But, 10 years later, after the war, Britain was "stuck with it" until the opportunity came to introduce 625-line, coincident with colour. The two systems have existed side by side since then, with 405-line mono gradually slipping into disuse as receivers were discarded. The shut-down in 405-line transmitters will begin next year, with 48 transmitters closing in 1982 and a further 36 in 1983. By the end of 1986, 405-line mono will have disappeared altogether from Britain's airwaves.

TECHNICS have announced the release of two new high quality receivers, which feature feather-touch tuning controls in place of the usual knobs and switches. The receivers, SA-313 and SA-515, will be marketed by National Panasonic (Aust) Pty Ltd. Both have quartz synthesiser digital tuning, with digital readout of the frequency selected, and 14 buttons for pre-selected stations (7 FM and 7 AM). Normal/narrow bandwidth switching improves reception in difficult FM service areas. The amplifier system in both cases is "New Class A" with power output ratings respectively of 35W and 55W per channel. Normal audio controls are provided, with facilities for two tape decks and two pairs of loudspeakers. (National Panasonic Aust Pty Ltd, 95-99 Epping Rd, North/Ryde, NSW 2113).

NATIONAL SEMICONDUCTOR CORPORATION has developed a noise reduction system that does not require a pre-encoded signal. It is therefore well suited to processing signals from radio tuners, especially in car systems. It is reportedly being taken up by Delco for use in receivers which it builds for General Motors. At the heart of the system is a single chip — the LM1894 — which applies the variable transconductance principle to achieve an automatic variation in audio bandwidth. As signal level falls to the point where noise is no longer masked, top-end response is restricted. A weighted noise reduction up to 14dB is said to be possible.

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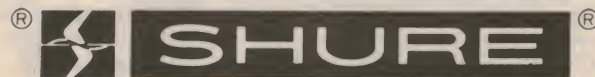
For technical service and advice, contact the Audio Engineers representative at the office in your State:—

CHECK THESE SPECIFICATIONS

Frequency Response: 50-15,000 Hz.

Polar Pattern: Cardioid (unidirectional), rotationally symmetric about axis, uniform with frequency.

Impedance: Microphone rating impedance is 150 ohms (180 ohms actual) for connection to microphone inputs rated at 19 to 300 ohms.



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HAWKINS AE162



Marantz SD5010 cassette deck

Easily the most interesting feature of the recently released Marantz SD5010 Stereo Cassette Deck is the tape transport which is incorporated in a slide in/slide out drawer. This innovative approach has enabled the designers to keep the height of the SD5010 to a low 73mm and allows the consumer to stack the unit into the middle of an equipment rack.

Aimed at the medium-priced range of cassette decks, the SD5010 conforms to Marantz' usual high standards of appearance and finish with the front panel being anodised in a satin gold colour. It incorporates all the desirable functions necessary for the simple making and playing back of recordings. In lieu of piano keys providing mechanical actuation of transport modes, touch buttons trigger logic circuits which activate solenoids to perform the required transport functions — a most desirable feature.

Physical dimensions of the Marantz SD5010 are 416mm wide x 73mm high x 302mm deep and mass is 6kg.

Internal design and construction is of the highest grade with exceptionally neat wiring from board to board and point to point. Located in the sliding drawer is a servo-controlled DC motor which suffices for all tape motions, while another DC motor — mounted near the left hand rear of the chassis — is used for opening and closing of the drawer. Projecting from the rear of the drawer is a threaded rod approximately 140mm long, which engages with a special nut. A nylon pulley wheel — some 30mm in diameter — fits over the nut, with the combination pulley/nut being mounted in a nylon bracket assembly so that it is free to rotate, but restrained from moving backwards or forwards.

The pulley is belt-driven from the adjacent motor, such that as the nut spins on the threaded rod the drawer is extended or retracted — in a rather similar manner to that of the common bench vice. Rotation of the motor is reversible to enable either opening or closing of the drawer. At the extremes of travel limit switches are tripped, cutting power to the motor and thus preventing further travel of the drawer. Generous bearings and guide rollers are used throughout the mechanism, so that it operates smoothly and with the minimum of noise.

Slim rectangular pushbuttons for

transport control are located on the front of the drawer, together with a tape counter and LED indicators which provide readouts of power ON, PAUSE and RECORD. A tape-run indicator is provided by the PAUSE LED which flickers whenever the tape is being driven by the capstan. Extension of the drawer is some 100mm and takes over five seconds. While this may seem a relatively short period, it can at times be rather frustrating having to wait before being able to remove or insert a cassette. Especially as the drawer has to be virtually fully extended before the cassette can be changed. And in common with other top loading cassette transports, it is not possible to take a quick glance from across the room to determine the quantity of tape remaining on the supply reel.

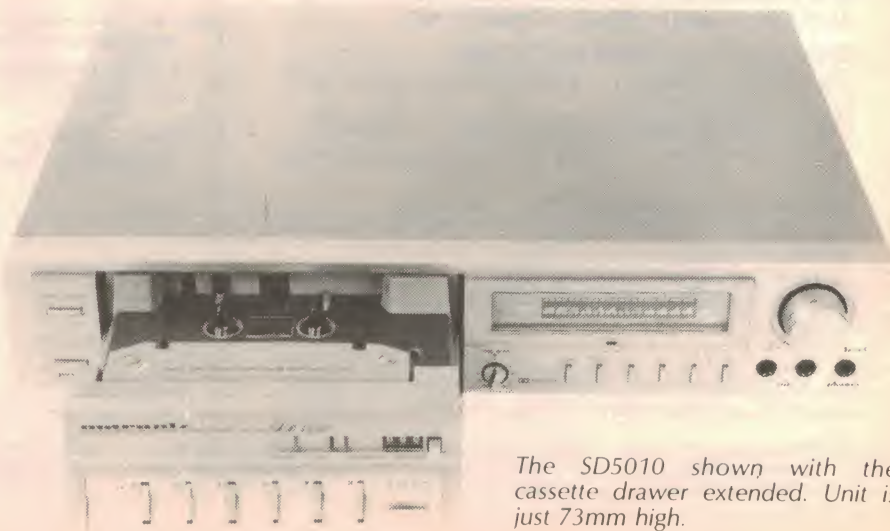
Conforming with current trends in marketing, a record MUTE button is included. When depressed during recording, it prevents the input signal from being recorded on tape, without having to turn down the record level controls or stop the tape. This allows a certain amount of "edit as you go" recording

since the outputs of the machine and the level meters still function during the record mute operation.

At the lefthand side of the front panel are two rectangular pushbuttons, the top one for drawer extend/retract, the lower for mains power. The front face — measuring 167 x 65mm — of the transport drawer is just to the right, whilst the twin bar level meter displays, vernier bias adjuster, tape type and Dolby B selectors occupy the greater part of the righthand section. At the extreme right are the dual concentric record gain controls, plus jacks for microphones and headphones.

The aforementioned vernier bias control adjusts the bias level over a small range and has a centre detent for "normal" setting, together with panel calibration marks, for remembering specific special settings. A table of settings for commonly available cassettes and adjustment instructions for other types of tape are included in the Owner's Manual. During the course of our performance testing we left this control in the centre (detent) position for the three tape types, with this being the recommended setting for the TDK SA and MA cassettes, and the optimum for the Ampex 20:20 (not listed in the table).

Level metering is performed by twin LED bar displays with the segments providing 12 discrete steps, eight coloured green from -30dB to 0dB, and those from +1 to +6 being red. Whilst at first glance there appear to be 16 green



The SD5010 shown with the cassette drawer extended. Unit is just 73mm high.

MARANTZ SD5010 CASSETTE DECK

segments, in reality there are only eight as each indicator light simultaneously appears in two windows. Although it is stated that the meters are "peak level displays", the advertising and owner's literature do not specify waveform nor dynamic characteristics. In common with most other low-cost level meters (either bar graph or moving coil) the calibration accuracy is within 0.5dB over the range from -10 to +3 but has an error 5dB at the -30dB point.

At the 0dB metering point line output level is 380mV RMS open-circuit. Internal output impedance is 8k Ω . Calibration of the metering circuit is such that a record-

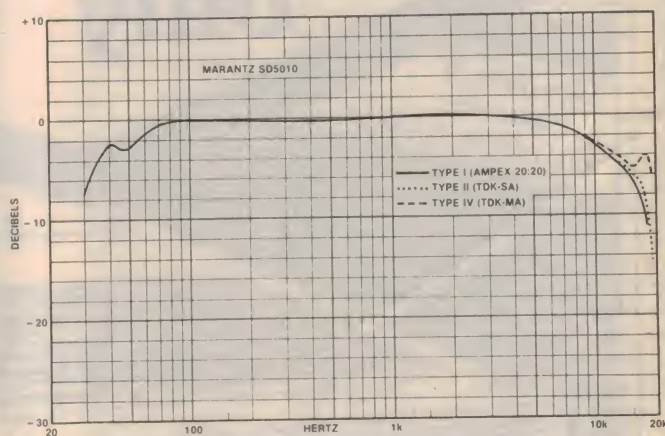
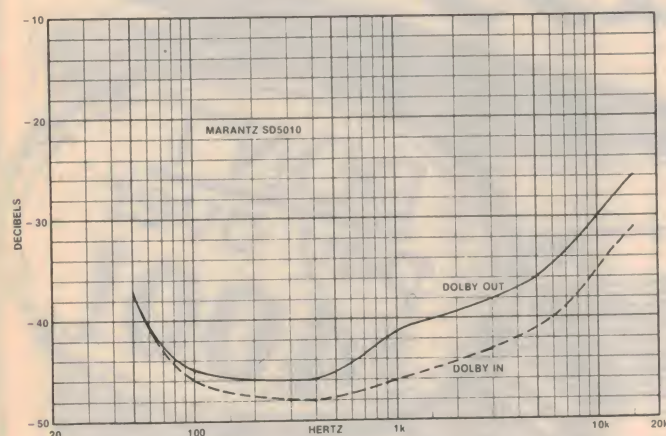
ween 40 and 10,000Hz, with the gentle roll-off to -6dB extending to 16kHz. At the 0dB level 1000Hz distortion was 1.7% increasing to 4% at the +6dB point. Unweighted signal-to-noise ratio remained at 46dB, but when using the 400Hz high-pass filter it improved to 54dB due to the 70 μ Sec replay characteristic being selected (Type-I cassettes are replayed with a 120 μ Sec characteristic).

Using a TDK MA cassette as a typical IEC "type-IV" metal sample we obtained an overall frequency response within ± 2 dB from 40Hz to 12kHz. The response fell to -5dB at 15kHz, rose to -4dB at 18kHz and then achieved -6dB at

DIN weighted, with slow cyclic variations between the two extremes. It was thought that the variations may have been due to the supply and/or takeup spindle drives. An endless loop cassette was substituted in an attempt to pinpoint the reason, but the measured wow and flutter remained essentially the same.

In conclusion, we found the performance of the Marantz SD5010 to be about on a par with other cassette decks in this price range. Its obvious attractions are excellent finish and presentation, together with a degree of operating refinement. All its controls are smooth, positive and quiet in action, inspiring confidence in the machine. It should give years of satisfaction.

Recommended retail price of the SD5010 cassette deck is \$359. RCA to



Above are the curves for separation between channels and records/replay response while below is a view inside the Marantz SD5010 deck.

ed level of 155 nWb/m (nanowebers/meter) produces 0dB replay level, however it is usual for true "peak-reading" meters to be calibrated such that a record level of some 250-300 nWb/m produces 0dB deflection.

We chose to use an Ampex 20:20 C60 cassette as the IEC "type I" ferric oxide sample, and obtained an overall frequency response within ± 2 dB from 40Hz to 10kHz, with a gentle roll-off to -6dB at 15kHz. At 1kHz distortion measured 1.6% at the 0dB level, rising to 3.2% at +6dB. Unweighted signal-to-noise ratio was 46dB referred to the 0dB level, improving to 53dB with a 400Hz high-pass filter. Interchannel separation was between 40 and 45dB for frequencies between 100 and 1000Hz, decreasing to 30dB at 10kHz. With Dolby-B noise reduction selected the separation figures improved by at least 5dB at 1000Hz and above. Crosstalk between tracks was well below the noise floor of the recorder over the entire audio passband. Separation and crosstalk performance is excellent, comparable with top-of-the-line decks.

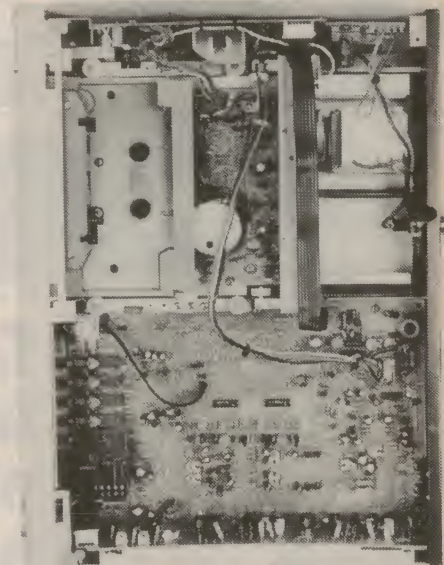
Changing to a TDK SA cassette sample — a typical IEC "type-II" chrome-compatible tape — the overall frequency response was again within ± 2 dB bet-

19kHz. At 1000Hz distortion measured 2.3% at 0dB, and 5.7% at +6dB. 47dB unweighted signal-to-noise ratio was obtained, and improved to 54dB with the 400Hz high-pass filter. Selecting Dolby-B decode improved the above figures to -51 and -62dB respectively.

With Dolby noise reduction selected, the record/replay frequency response tracked within ± 1 dB of the previous figures up to 10kHz, and remained within ± 2 dB to 15kHz. Conforming to the Dolby B licensing arrangement, the SD5010 includes an MPX filter, which is automatically switched-in whenever Dolby is selected. As is generally known an MPX filter puts a sharp notch in the response at 19kHz to filter out any residual stereo pilot tone signal from an FM tuner. (Excess 19kHz residual could cause mistracking of the Dolby circuits unless so removed.)

As received, the azimuth alignment of the record/replay head closely agreed with the Philips' standard, as did the replay frequency response which was well within ± 2 dB to 10kHz, the upper limit on our test tape.

Tape speed was within ± 0.1 % of the standard, while fast forward and rewind times were each approximately 105 seconds for a C60 cassette. Peak wow and flutter varied between 0.1 and 0.25%



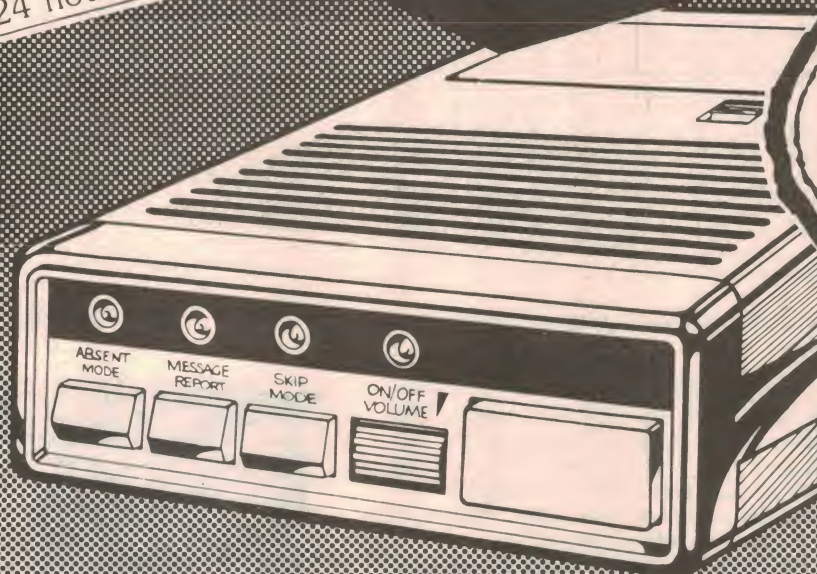
RCA audio cables are supplied with the unit, with four RCA sockets being located on the back panel for line input and output connections. Further details can be obtained from high fidelity retailers or the distributors, Marantz (Australia) Pty Ltd, 32 Cross St, Brookvale, NSW 2100.

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Machine only \$199⁰⁰**

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*With this optional remote beeper you can actually dial your number from any other phone & listen to any messages that have been recorded - imagine how handy that would be for busy people on the move! You can capture important calls without having to go to the office.

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have halved the cost of
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DICK SMITH

Huge price breakthrough

Traditional telephone answering units are enormously complex and expensive. In this revolutionary unit most of the components have been replaced by one "microprocessor" (computer) integrated circuit which not only means greater reliability but also vast savings in cost. **To purchase this unit outright you will probably spend less than one years lease payments on competitive units**

NOT AS GOOD

This unit has some tremendous advantages over competitive units however we must first tell you of one disadvantage. With competitive units selling for \$400-\$500 a sales representative will call, demonstrate and quote you. However, because of the extremely low price of this unit we can only sell it directly "over the counter" or by mail order. The profit we make wouldn't even run a traditional salesman's car for very far!

but far better

Many telephone answering units (including this one) can have remote beepers. This means that when you wish to retrieve a message, you simply 'phone your number, hold the beeper to the 'phone and the telephone answering machine then rewinds to the start of your first message and plays back. However, with most units if you then wanted to erase these messages and rewind, it was either impossible or extremely complicated. This unit solves the problem as you can command the machine to rewind from your beeper at any time.

Remote control of your machine from any other phone!



easy to install

The telephone answering unit simply plugs into the power and connects to your telephone (Telecom install a socket at a nominal charge). We even supply instructions on how you can easily install it yourself in seconds where Telecom regulations do not apply

incredibly small

Microprocessor technology has reduced the machine to 25.5 x 15 x 6cm. (your telephone sits on top perfectly) and the unit will record up to 45 messages on the standard cassette tape (many other machines have special tapes costing over \$20.00).

You don't have to pay for special tapes costing \$20 or more!

Features:

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- Supplied with pre-recorded cassette tape - unit ready for immediate use
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- Unit has "No message received" signal on remote call-in.
- Last message received signal
- Signal for tape fully recorded with incoming messages
- Book size - fits under your telephone

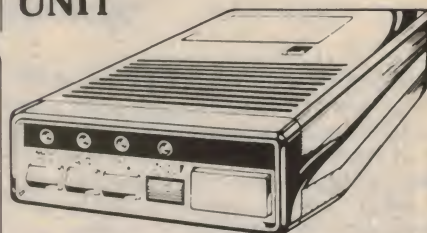
no wasted time

With our unit there is a special beep tone that tells you the moment you call in if there's a message. It also tells you if you have finished listening to the last message.

**This saves you time and money!
try it yourself—no obligation**

We are so confident of this computer controlled marvel that we are happy for you to try it yourself for 14 days and if you are not completely satisfied, simply return it to us in its original condition and we will refund your money in full.

XK-2100 TELEPHONE ANSWERING UNIT



Cat. Y-2173 **\$199⁰⁰**
P&P \$5 50

OPTIONAL REMOTE BEEPER

(Allows you to interrogate machine from another phone).

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2-Channel Infrared Remote Control

Use it to switch mains appliances on or off

Need an inexpensive two-channel remote control? Well our new Infrared Remote Control has a range of 20 metres and can independently control two appliances. You can use it to turn off (or mute) the sound output of a TV receiver during commercials or switch lights, alarms, radios etc. The applications are limited only by your imagination.

by RON DE JONG

Remote controls come as standard equipment with many television sets and some of the latest cassette decks but, as far as we know, there are no commercially available remote controls designed to simply switch appliances on or off. Considering the number of possible applications for such a unit, we think that our new Infrared Remote Control will be quite popular.

The most obvious application is to switch the TV sound off during commercials. This is quite easily done with our new unit because each of the two channels controls a relay. It is simply a matter of connecting the relay contacts of one channel in series with one of the speaker leads. Muting can also be provided by connecting a suitable resistor across the relay contacts.

Because the unit has relay outputs it can be used to directly switch mains ap-

pliances (lights, alarms, motors, heaters etc). It could be used, for example, to activate a motor-driven curtain rail or to switch the jug on. If you've ever woken up in the morning and felt that you just couldn't get out of bed (at least not for a few minutes), then the Infrared Remote Control is just the thing — press one button and the curtains open to a bright sunny morning; press the other and the "jug's on the boil".

As an additional benefit we have also provided an option for using the remote control as a light beam relay. In this role, it is similar to the unit described last month, except that this unit will switch mains operated alarms.

The unit consists of two parts: a small hand-held battery operated transmitter and a larger receiver unit. The front panel of the receiver features three LED indicators: one is the power indicator

while the other two indicate whether channel one or two are on/off.

There are two buttons on the transmitter, one each for the two channels. If the button for one particular channel is pressed that channel will, for example, turn on. When the same button is pressed again that channel will turn off. In other words, the output alternates between on and off each time the button is pressed.

Range of the remote control is over 20 metres which should be sufficient for most situations. Because infrared light reflects off walls and ceilings the transmitter does not have to be pointed directly at the receiver — it will operate the receiver when pointed in almost any direction in the same room.

THE CIRCUIT

Circuitry for the receiver and transmitter is relatively simple and low in cost. The hand-held transmitter uses one CMOS IC, a Darlington transistor and a couple of infrared light emitting diodes. The receiver uses just five transistors, four CMOS ICs and two relays.

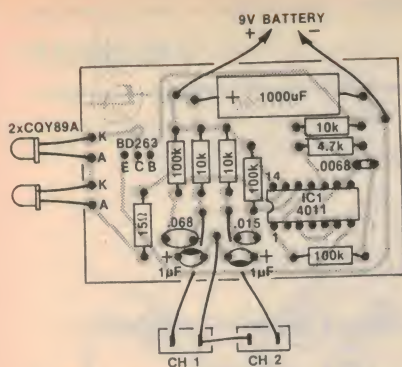
Let's look at the transmitter circuit first: This uses a 4011 quad NAND gate and three of the gates, 1a, 1b and 1c, are arranged as a standard three-gate CMOS oscillator with the exception that one of the inputs of gate 1a is used to "enable" the oscillator. The oscillator runs at 10kHz and is enabled, ie, it runs, whenever pin 2 of the 4011 is high. Pin 2 is controlled by gate 1d which pulls pin 2 high when either one of its inputs, pins 12 and 13, are pulled low.

Normally both inputs of gate 1d will be high by virtue of the 100kΩ pull up resistors at each input. If one of the buttons is pressed, however, the resistor capacitor network associated with that button generates a short pulse as follows. Looking at the "CH 1" button, for example, there is initially no voltage across the .068μF capacitor since both sides have been pulled up via the 10kΩ and 100kΩ resistors.

When the "CH 1" button is pressed, however, the switch side of the capacitor goes low and because the voltage across the capacitor cannot

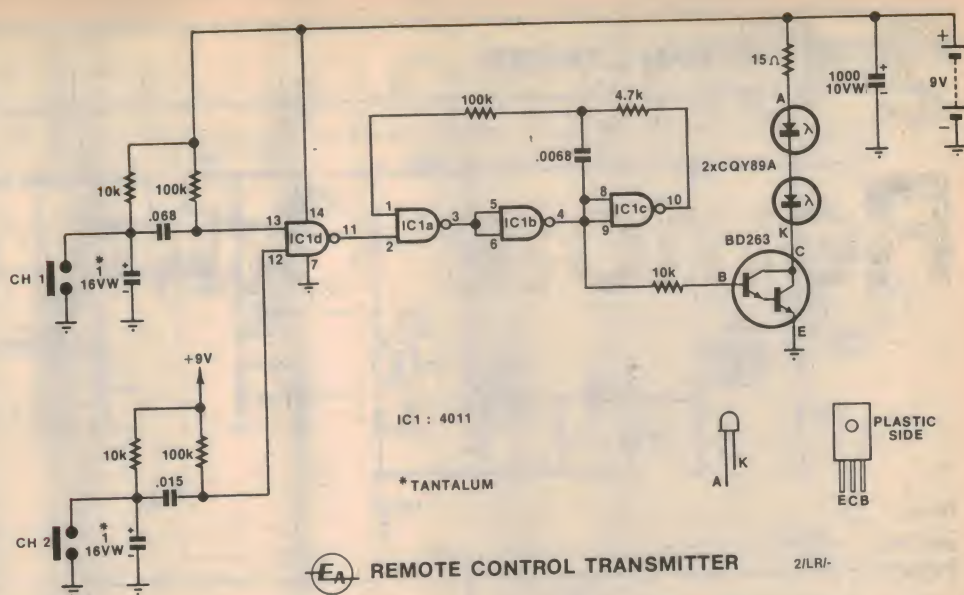
The completed remote control receiver (left) with its companion transmitter unit.





ABOVE: The component overlay diagram for the transmitter circuit.

RIGHT: The transmitter consists of a CMOS oscillator and a Darlington transistor output stage driving two infrared LEDs.



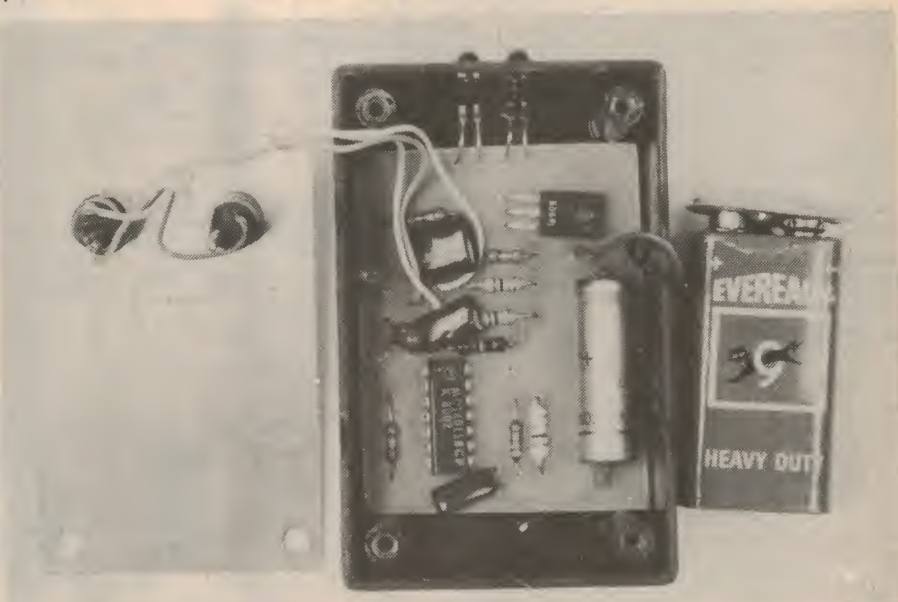
change instantaneously the pin 13 input of gate 1d will also go low, forcing the output of 1d high and enabling the oscillator.

Eventually the voltage at the input of the gate will reach $\frac{1}{2}V_{CC}$ as the $.068\mu F$ capacitor is charged via the $100k\Omega$ pull up resistor and the output of gate 1d will again return to zero and disable the oscillator. The period for which the oscillator is enabled is dependent on the time constant of the $.068\mu F$ capacitor and $100k\Omega$ resistor and is roughly 6ms. The pulse length generated by the "CH 2" button circuit is similarly dependent on the $100k\Omega$ resistor and $0.015\mu F$ capacitor in its circuit, and is about 1ms.

The $1\mu F$ capacitors across the "CH 1" and "CH 2" buttons provide debouncing. If the switch momentarily opens due to contact bounce the voltage across the switch will not immediately change because of the time constant of the $10k\Omega$ pull up resistor and the $1\mu F$ capacitor. The time constant selected is long enough to prevent any multiple pulses but is short enough to allow either button to be pressed several times in rapid succession.

The CMOS oscillator drives an output stage consisting of a BD263 Darlington transistor and two infrared light-emitting diodes. A $10k\Omega$ resistor limits the base current of the Darlington and prevents the output of the oscillator from being unduly loaded. The Darlington provides the necessary gain and high current capability to drive the LEDs while the 15Ω series resistor limits the LED current to a safe value and prevents damage to the LEDs.

Even so, the peak current is more than 300 milliamps which is more than the battery could supply on its own. Most of that peak current is supplied by the $1000\mu F$ capacitor which means that the battery has an easier job. When the buttons are not being pressed, the current drawn from the battery is very low, typically around 10 microamps, so we



Inside the assembled transmitter unit. Note how the infrared LEDs are arranged.

have omitted a power switch. Even with very frequent use, we estimate that the battery should last for more than one year.

The infrared diodes used are Philips type CQY89A. They are plastic-pack devices and are similar in appearance to the familiar red LED, except that the plastic encapsulation is a deep violet colour.

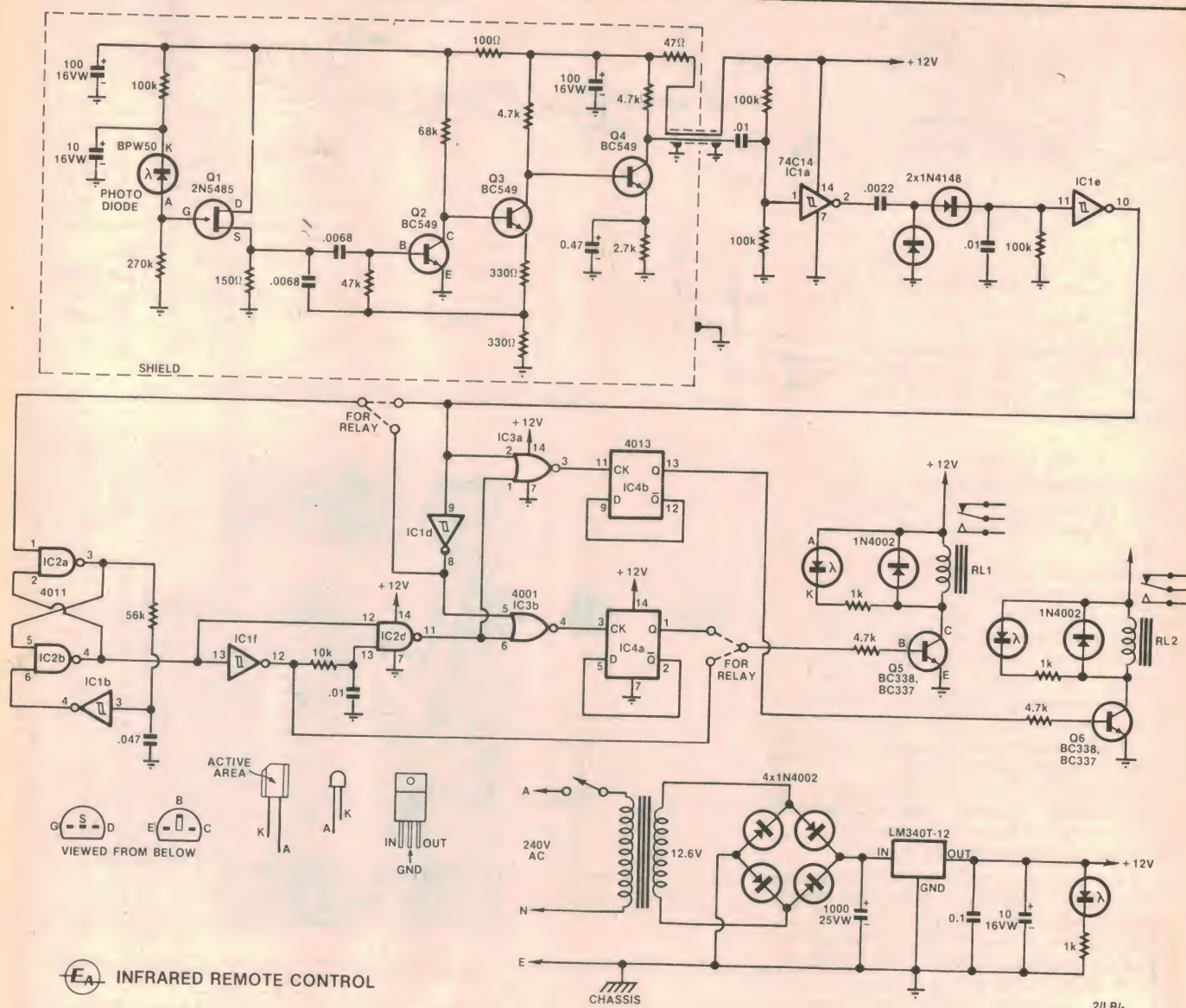
The receiver circuit consists of two distinct parts: a preamplifier and a decoding circuit. The preamplifier amplifies the infrared signal from the transmitter and generates a high-level signal for the digital decoding circuitry. Due to the sensitivity of the preamplifier, it is enclosed in a separate diecast box mounted inside the receiver. This is standard practice in commercial remote control units.

The preamplifier is similar to the circuit used in the Infrared Relay (see April issue) but with some component changes to account for the different sup-

ply voltage. Infrared light generated by the LEDs is picked up at the receiver by a special infrared photodiode, Philips type BPW50. This device is specifically designed to match the CQY89A LED, and includes an integral infrared filter that almost completely rejects visible light.

In operation the BPW50 photodiode acts essentially as a current source, ie, it generates a current proportional to the incident light. To generate a usable voltage signal we have connected the photodiode in series with a $270k\Omega$ resistor. The voltage across the resistor will thus be related to the incident light.

The other (cathode) side of the photodiode is connected to the +12V supply via a simple decoupling network consisting of a $100k\Omega$ resistor and $10\mu F$ capacitor. In this configuration the BPW50 is reverse-biased, giving two important benefits: it reduces the sensitivity of the circuit to ambient light; and it reduces the junction capacitance of the



The circuit shows optional links for those who wish to experiment with single channel relay operation (see text).

photodiode and hence increases the frequency response.

The upper limit to the frequency response is in fact determined by the junction capacitance, the 270k Ω resistor and the capacitance of the following stage, and is about 40kHz – well in excess of the 10kHz frequency we want to receive.

The signal from the photodiode is fed to Q1, a 2N5485 JFET. The JFET is connected as a "source follower" and offers a high input impedance, a low output impedance, and a voltage gain of 0.3 to 0.5. This sort of impedance matching would be difficult to achieve using bipolar transistors and the circuit would be more complex than the simple "self biasing" JFET circuit we have used.

Following the JFET buffer stage is a two-transistor bandpass filter comprising

transistors Q2 and Q3. Centre frequency of the filter is around 10kHz and the Q is 10; ie the bandwidth of the filter is 1kHz. The response of the filter is wide enough to pass the 10kHz signal from the transmitter, even allowing for some mistuning between the transmitter and filter frequencies, but it is selective enough to almost completely eliminate interference from other sources (eg fluorescent lights).

There are still some harmonics generated by fluorescent lights which extend up to 10kHz and beyond, however, and this plus other factors limit the ultimate sensitivity of the receiver.

The filter circuit used is called a "multiple feedback" filter and is commonly used with op-amps, though we have adapted the circuit for use with a transistor amplifier. Disregarding the two

.0068 μ F capacitors for the moment, Q2 and Q3 form a two-stage inverting amplifier. Both transistors operate as common emitter amplifiers, with the second stage providing two separate outputs: one from Q3's collector and the second from the junction of the two 330 Ω emitter resistors.

Biasing of the circuit is achieved by the 47k Ω resistor from Q3's emitter back to the base of Q2. The actual filter com-

We estimate that the current cost of parts for this project is about

\$65

including sales tax.

Bill Edge's

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INFRA-RED LIGHT BEAM RELAY

EA March '81. There are hundreds of uses for this fantastic EA designed kit. Phone for full details of the kit.

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'Le Gong'

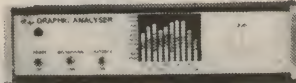
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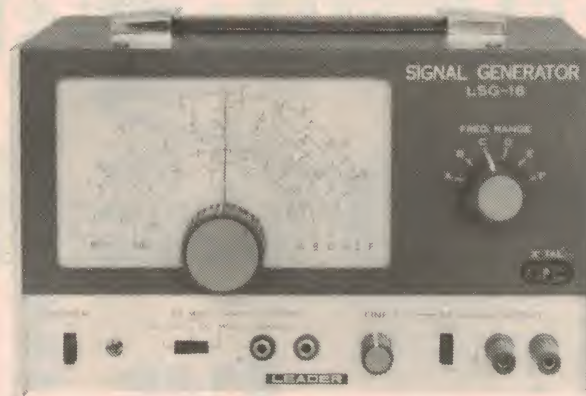
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- (E) 10 MHz-35 MHz;
- (F) 30 MHz-100 MHz;

Harmonics: 90 MHz-

300 MHz. **Accuracy:** $\pm 1.5\%$

Output: 0.1 Vrms or higher to 100 MHz. **Modulation:**

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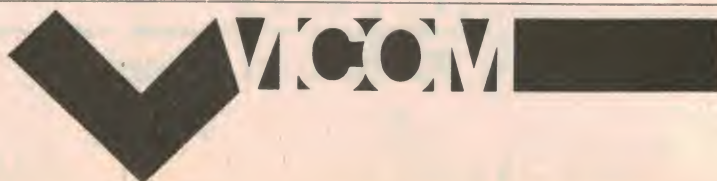
Frequency Range: 1.5 to 250 MHz in 6 bands. **Power supply:** 9V battery. **Oscillator:** Uses 1.15 MHz crystal.

Semiconductor complement: 2 transistors and 1 diode. **Size and Weight:** 175(H) x 65(W) x 50(D). 0.5 kg approx

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ponents are the two $.0068\mu\text{F}$ capacitors, the $47\text{k}\Omega$ resistor and the 100Ω output impedance of the JFET buffer. These determine the centre frequency and Q of the filter.

The collector output of Q3 provides an amplified version of the filter output which is DC-coupled to Q4, another common emitter amplifier. Q4 provides an additional gain of around 150 and, because of the emitter bypass capacitor, also provides further attenuation of unwanted low frequency signals.

Following Q4 the signal is AC-coupled to the digital decoding circuits. IC1a is a CMOS Schmitt trigger whose input (pin 1) is biased at half the supply voltage by the two $100\text{k}\Omega$ resistors. When the amplitude of the signal from Q4 exceeds the upper and lower trigger levels of the Schmitt trigger, the device will generate a squared up version of the signal.

The output of IC1a will therefore be a brief 10kHz signal either 1ms long or 6ms long, depending on whether the "CH 1" or "CH 2" transmitter button was pressed. These bursts of 10kHz signal are decoded into digital pulses of the same duration by a diode-pump circuit consisting of two 1N4148 diodes, $.0022\mu\text{F}$ and $.01\mu\text{F}$ capacitors, and a $100\text{k}\Omega$ resistor.

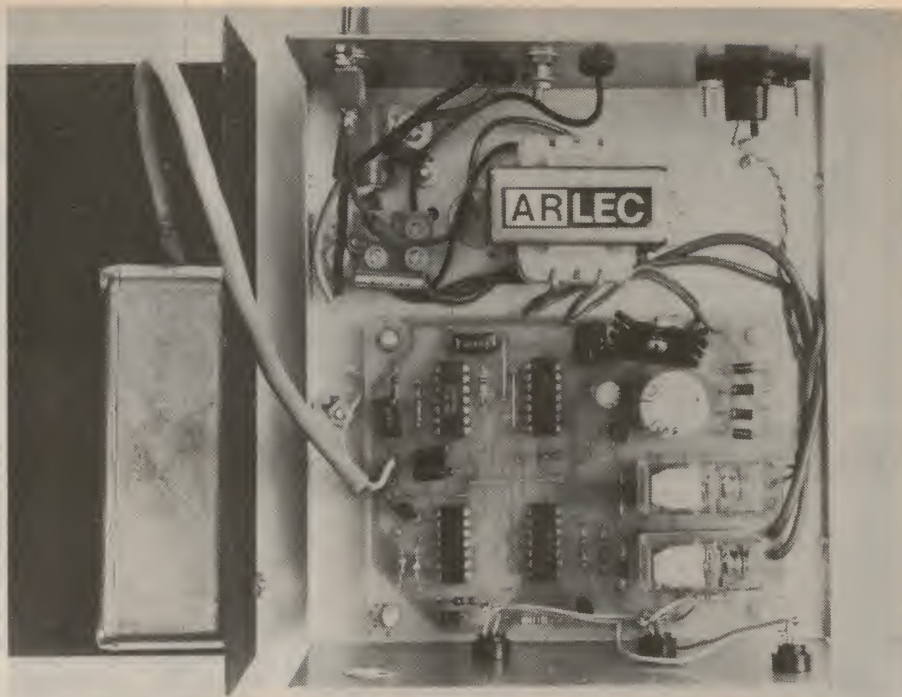
The circuit is actually an AC-coupled rectifier, but the $.0022\mu\text{F}$ coupling capacitor is about five times smaller than the $.01\mu\text{F}$ filter capacitor. So any one cycle of the transmitted signal, or even interference, will charge up the $.01\mu\text{F}$ capacitor only fractionally and some five cycles of signal are required to charge up the $.01\mu\text{F}$ capacitor to the trigger voltage of the following Schmitt trigger IC1e. This provides some degree of interference suppression but does not affect the sensitivity of the receiver.

So now we have a digital pulse from IC1e with pulse length dependent on which button was pressed on the transmitter. To control the appropriate relay we have to be able to distinguish between the two pulses and this is accomplished by a decoding circuit consisting of IC2, a 4011 CMOS quad NAND gate, and IC3, a 4001 CMOS quad NOR gate.

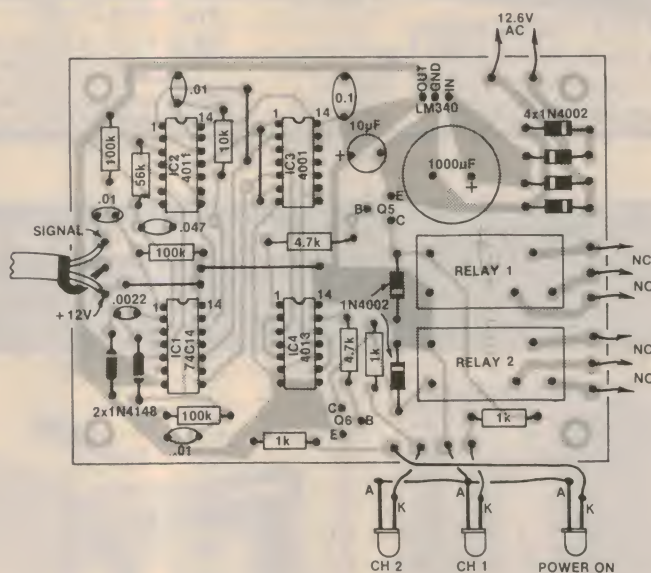
Heart of the circuit is a monostable consisting of IC2a and IC2b arranged as an RS flipflop. The R and S inputs are pin 6 of IC2b and pin 1 of IC2a respectively. Normally both inputs are high but when a low pulse is received the Set(S) input goes low, latching the flipflop outputs pin 3 high and pin 4 low.

The flipflop now remains latched regardless of the Set input but is reset after about 4ms by Schmitt trigger IC1b. Normally, the input of IC1b is low. When the output of IC2a (pin 3) goes high, the $.047\mu\text{F}$ capacitor charges up via the $56\text{k}\Omega$ resistor until the trigger voltage is reached some 4ms later. IC1b then generates the Reset pulse to pin 6 of IC2b.

The 4ms monostable pulse from pin 4 of IC2b is then used to produce a narrow



Inside the completed remote control receiver. The earth track on the PCB should be connected directly to chassis as shown at left.



Component overlay diagram for the main receiver PCB. The spare holes permit the optional linking arrangement for single channel relay operation.

trigger pulse 4ms after the beginning of the signal from the transmitter is received. This trigger pulse is generated by inverting the monostable pulse, delaying it via the $10\text{k}\Omega$ and $.01\mu\text{F}$ RC circuit and NANDing with the original monostable signal. Since the output of IC2d will only go low when both inputs are high, it will generate a pulse equal to the delay of the RC circuit.

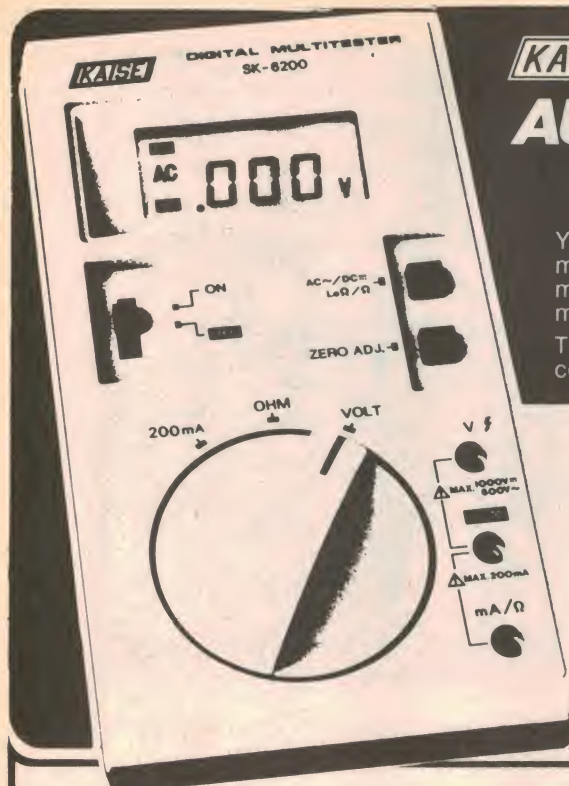
The trigger pulse thus occurs after the end of the 1ms "CH 1" signal but during the 6ms "CH 2" signal, and is fed to the pin 1 and pin 6 inputs of CMOS NOR gates IC3a and IC3b. The other input of IC3a is fed the received pulse direct from IC1e, while the input to pin 6 of IC3b is an inverted version of this signal. Since

both inputs of a NOR gate must be low for its output to go high, only one of the two NOR gates will pass the trigger pulse from IC2d, depending on the length of the received signal.

To explain further, when a "CH 1" 1ms pulse is received, the pin 5 input of IC3b will be low by the time the trigger pulse occurs while the pin 2 input of IC3a will be high. Hence only IC3b passes the trigger pulse.

IC3a operates in similar fashion whenever a "CH 2" 6ms pulse is received.

The signal pulses from the NOR gates trigger either IC4a or IC4b, both CMOS D flipflops. These are configured so that each pulse to the clock input of the



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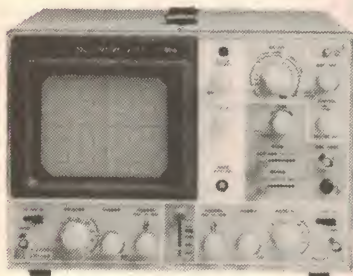
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flipflop toggles its output state. Outputs from the flipflops drive transistors Q5 and Q6 via current-limiting resistors and these in turn drive 12V SPDT relays. A diode across each relay protects its associated driver transistor from inductive kickback when the relay is de-energised.

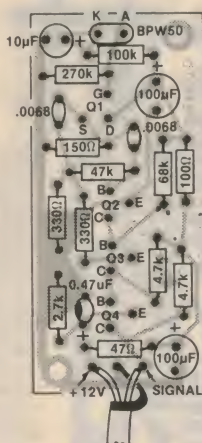
Also wired across each relay is a series LED/1k Ω resistor combination to provide channel on/off indication.

For those who wish to experiment, the circuit shows optional links for relay type operation (eg a burglar alarm). In this mode, the infrared transmitter described last month is used. When the beam is broken, the unit triggers, turning relay one on for a period set by the 56k Ω resistor and .047 μ F capacitor in the monostable circuit. The .047 μ F capacitor should be increased to 10 μ F and the 56k Ω resistor increased to 1M Ω for a 10 second period.

The whole unit is powered from a simple power supply consisting of a 12.6V transformer, a bridge rectifier and 1000 μ F filter capacitor, and a three terminal 12V regulator. High frequency decoupling is provided by the 10 μ F and 0.1 μ F capacitors. The power indicator LED is wired to the +12V supply via a 1k Ω current limiting resistor.

CONSTRUCTION

Construction can begin with the receiver, which is housed in a metal case measuring 150 x 76 x 134mm (D x H x



LEFT: Here is the component overlay diagram for the pre-amplifier/filter PCB.



RIGHT: The preamplifier PCB is mounted inside a metal diecast case. Note how the BPW50 infrared photodiode is arranged.

W), although any metal case of sufficient size can be used.

Most components are mounted on two printed circuit boards (PCBs): a main board coded 81rc4a and measuring 79 x 105mm; and a preamplifier board coded 81rc4b and measuring 74 x 33mm. Use the board overlays provided to mount the components and take the usual precautions with component polarity and with the CMOS ICs. Note that the BPW50 photodiode is mounted using almost its full lead length, as shown in one of the photographs.

A separate aluminium diecast case measuring 92 x 38 x 31mm is used to house the preamplifier PCB. You will have to drill two mounting holes for the

board, together with a 12mm diameter hole in the front of the case to allow light access to the BPW50 photodiode. A smaller 5mm hole at the other end of the diecast case carries the output cable to the main PCB.

With the preamplifier assembly and main PCB completed, the various components can be mounted inside the receiver case. Use the layout shown in

PARTS LIST

- 1 metal case, 150 x 76 x 134mm
- 1 diecast aluminium case, 92 x 38 x 31mm
- 1 plastic zippy box, 83 x 54 x 28
- 1 PC board coded 81rc4a, 79 x 105mm
- 1 PC board coded 81rc4b, 74 x 33mm
- 1 PC board coded 81rc4c, 61 x 42mm
- 1 transformer, type 2851 240V to 12.6V
- 2 12V SPDT PC-mounting relays
- 1 240VAC SPDT miniature toggle switch
- 2 momentary contact pushbutton switches
- 1 9V transistor battery, Eveready 216 etc
- 1 battery clip to suit battery
- 4 9mm Richco plastic board supports
- 15cm of twin-conductor shielded cable
- 1 mains cord and plug
- 1 3-way mains terminal strip
- 1 mains cord clamp and grommet

- 1 surface mounting mains socket (optional, see text)
3 small grommets (optional)
1 speaker socket (optional)

SEMICONDUCTORS

- 2 4011 CMOS quad NAND gates
- 1 4001 CMOS quad NOR gate
- 1 74C14 CMOS hex Schmitt inverter
- 1 4013 dual D flipflop
- 1 LM340T-12 three terminal regulator
- 1 BD263 NPN Darlington transistor
- 2 BC337 NPN transistors
- 3 BC549 NPN transistors
- 1 2N5485 N-channel JFET
- 1 BPW50 infrared photodiode
- 2 CQY89A infrared LEDs
- 3 large LEDs (assorted colours)
- 6 1N4002 power diodes
- 2 1N4148, 1N914 diodes

CAPACITORS

- 1 1000 μ F 25VW PC electrolytic
1 1000 μ F 10VW axial electrolytic
2 100 μ F 16VW PC electrolytics
2 10 μ F 16 VW PC electrolytics
2 1 μ F 16VW tantalum

- 1 0.47 μ F 25VW tantalum
1 0.1 μ F metallised polyester
(greencap)
1 .068 μ F greencap
1 .047 μ F greencap
1 .015 μ F greencap
3 .01 μ F greencaps
3 .0068 μ F greencaps
1 .0022 μ F greencap
1 0.02 μ F 250VAC metallised paper
(optional, see text)

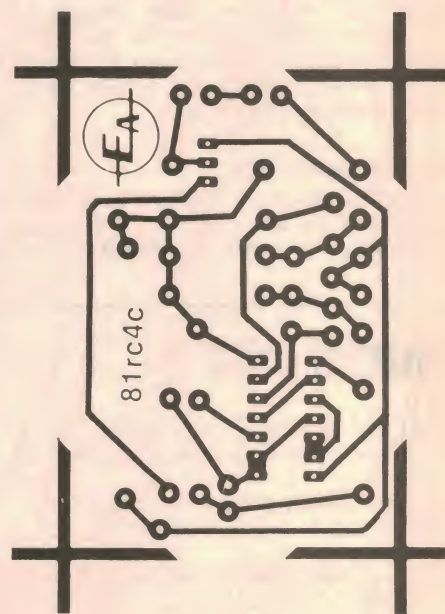
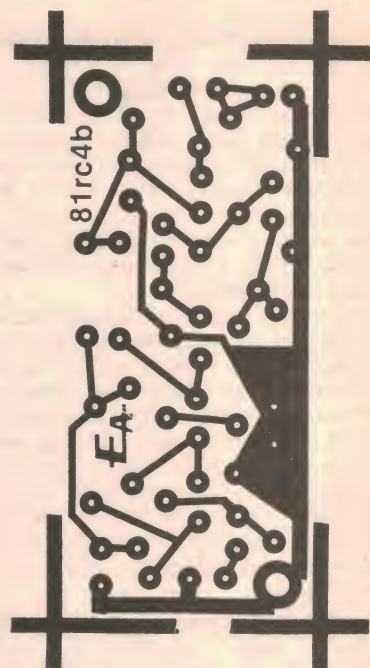
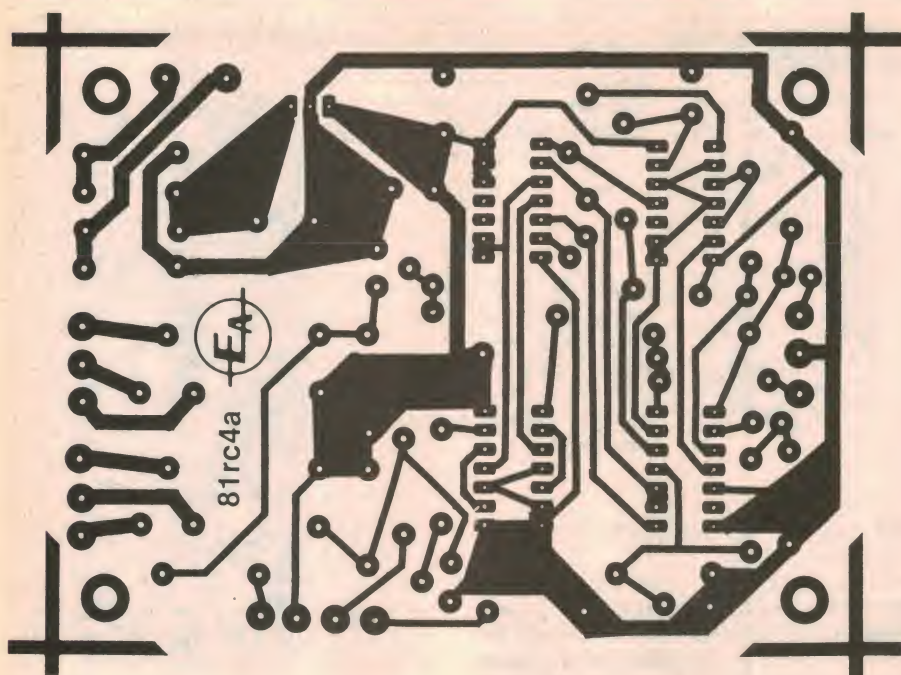
RESISTORS (all 1/4W, 5%):

- 1 x 270k Ω , 7 x 100k Ω , 1 x 68k Ω , 1 x 56k Ω , 1 x 47k Ω , 4 x 10k Ω , 5 x 4.7k Ω , 1 x 2.7k Ω , 3 x 1k Ω , 2 x 330 Ω , 1 x 150 Ω , 1 x 100 Ω , 1 x 47 Ω , 1 x 15 Ω .

MISCELLANEOUS

Machine screws and nuts, hookup wire, mains rated wire, solder lugs, solder etc.

NOTE: Ratings are those used in the prototype. Components with higher ratings may generally be used provided they are physically compatible.



the photographs to drill the relevant mounting holes and don't forget to drill a 12mm hole in the front panel to line up with the hole in the preamplifier case.

The preamplifier is mounted on one side of the case using the same screws used to secure the preamplifier PCB. It must be arranged so that, when the assembly is completed, the BPW50 photodiode sits just behind the front panel. We used 9mm Richco plastic board supports to mount the main PCB and connected it to the preamplifier via a 120mm length of twin-core shielded cable.

It is a good idea to earth the main PCB directly to the case via a solder lug, and to fit a small aluminium heatsink to the LM340T-12 regulator IC to aid heat dissipation.

The mains cord should be passed through a grommetted hole in the rear of the chassis and anchored with a cord clamp. Terminate the mains active (brown or red) and neutral (blue or black) wires to the insulated terminal block and solder the earth (green or green with yellow stripe) wire to a solder lug near the transformer. The mains on/off switch is mounted on the rear panel, and should be wired to switch the active line to the transformer primary.

This done, the transformer can be bolted into position and its secondary leads terminated directly to the PCB. The primary leads are connected to the neutral terminal on the mains terminal block and to the on/off switch. Keep all mains wiring neat and tidy, and sleeve the terminals of the on/off switch with plastic tubing to avoid the possibility of electric shock.

Note that a 0.1 μ F 250VAC (ie mains

rated) capacitor must be connected across the relay contacts when switching mains appliances. This is to prevent turn-off voltage spikes from triggering the circuitry. This capacitor can be mounted on the mains terminal strip.

We wired our unit so that one relay is used to switch a mains output socket bolted to the rear of the case. If you elect to do the same, make sure that all wiring to the relay contacts and to the socket is mains rated. The wiring is most conveniently run to the mains socket via the mains terminal strip.

The second relay in the prototype was wired to a 2-pin speaker socket and is intended to switch low voltage circuitry.

The transmitter is built on a PCB measuring 61 x 42mm (code 81rc4c), and is housed in a small plastic zippy box.

The "CH 1" and "CH 2" buttons are mounted on the aluminium front panel of the plastic case, about 18mm from one end of the panel and about 21mm apart from each other. The only other modifications to make to the box are to drill two holes for the infrared LEDs. These should be drilled 8mm from the bottom of the case and about 8mm apart.

The transmitter PCB has no mounting holes and is designed to sit at the bottom of the case, being held in place by the battery and the lid of the box. There should be no problems with this arrangement. In fact there are some distinct advantages; no screws underneath the case to scratch furniture (the prized coffee table) and it also makes assembly easier.

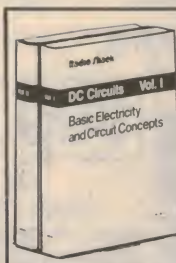
The IR LEDs should protrude from the case by at least 5mm so that the emitting

portion of the diodes is completely exposed to improve the range of the transmitter within a room.

The capacitors should be laid flat on the board so that they have a low profile. This is necessary in order to accommodate the battery which sits immediately between the board and the lid of the case, albeit with a thin layer of foam sandwiched between them.

Finally, go over all the wiring in the transmitter and receiver units and check that it is correct. Pay particular attention to the mains wiring, especially if you have wired up the optional mains output socket. To test the unit, simply switch on and check for correct operation.

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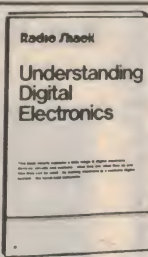


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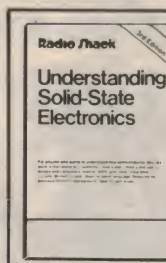


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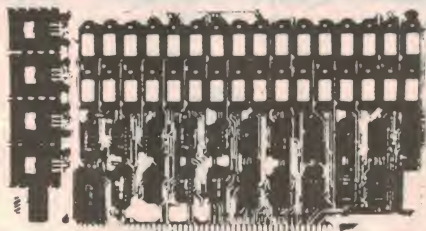
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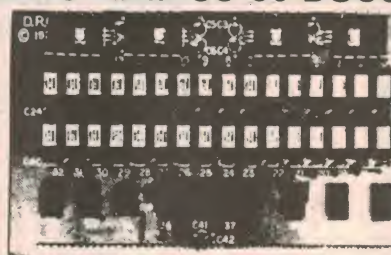
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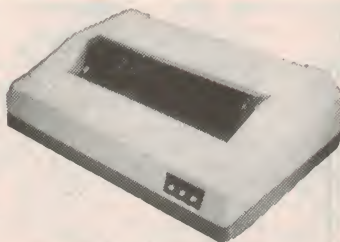
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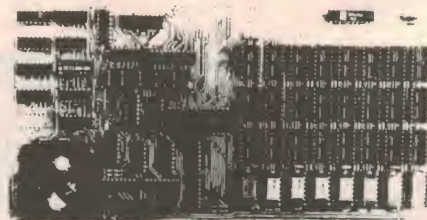
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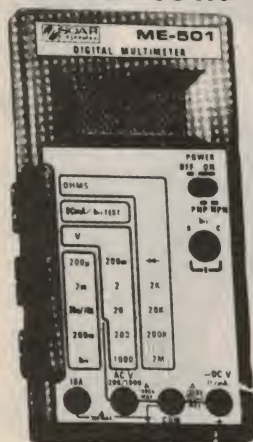
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Kit of parts as featured in Electronics Australia July, 1980. Programs 2708, 2716 and 2532. Use with TRS80, Sorcerer, and Compucolor. Kit does not include connector from the programmer to computer.

Complete Kit **\$72.49**
Kit without case **\$59.99**
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DIG CAPACITANCE METER

Kit of parts featured in Electronics Australia March, 1980. Four digits.

Complete Kit **\$52.49**
Kit without case **\$39.99**
Pack and post **\$2.50**

COMPONENTS

| | |
|----------------------|----------|
| 4116 RAM | \$3.00 |
| 2114 RAMS | 2.90 |
| 2708 EPROM | 6.90 |
| 741's 10 up | 2.50 |
| 555's 10 up | 2.90 |
| BD139 10 up | 5.50 |
| BD140 10 up | 5.50 |
| SC141D 10 up | 11.00 |
| SC151D 10 up | 21.10 |
| RED LEDS 10 up | 1.40 |
| RED LEDS 100 up | 11.00 |
| YELLOW LEDS 10 up | 2.30 |
| 8 PIN I/C SKTS 10 up | 2.00 |
| BC548 | 0.15 ea. |
| BC549 | 0.19 ea. |
| MJ802 | 3.60 |
| 6.800/50V CAPS (LUG) | 4.50 |
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COMPUTER COMPONENTS

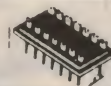
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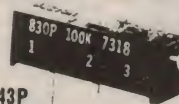
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20 TURN CERMET TRIM POT



SPECTROL 43P ACTUAL SIZE

STOCK RESISTANCE VALUES
10R, 20R, 50R, 100R, 200R, 500R, 1K,
2K, 5K, 10K, 20K, 50K, 100K, 200K,
500K, 1M, 2M

1—9 **\$1.40**
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Spectral model 63P
ACTUAL SIZE

STOCK VALUES

10R, 20R, 50R, 100R, 200R, 500R, 1K,
2K, 5K, 10K, 20K, 50K, 200K, 500K,
1M, 2M

1—9 **\$1.00**
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Measure sound from 30 to 120dBA +

Sound Level Meter

Noise is one of the many pressures of today's often stressful lifestyle. To be able to combat noise in its many forms, you must first be able to measure it. Here is the means: a low-cost sound level meter which will measure sound levels of less than 30dB to more than 120dB with fast or slow response to the "A" weighting curve.

by JOHN CLARKE

As time goes on, noise will increasingly be regarded as an unnecessary byproduct of technology rather than an incidental and innocuous side-effect of progress. More and more, noise is being actively proscribed or prescribed by law: noise levels in factories, of vehicles, and even of your party after certain hours. At the same time, excessive noise is being recognised as injurious to hearing and health in general, so it is useful for the concerned individual to know just how loud are the noises to which he or she is exposed every day.

There is no question that many power tools and appliances found in the home produce noise at levels which are potentially harmful to hearing, to mention but a few: lawnmowers, food mixers and blenders, power drills, and routers, planers and circular saws. These dangerous levels can readily be identified with our Sound Level Meter.

At the same time, our Sound Level Meter may help you tolerate noises that really are not all that loud but seem to be insistently intruding upon your consciousness — your neighbour's radio giv-

ing the Saturday afternoon race commentary, passing traffic, planes flying overhead. Many of these noises can be very irritating but are really at a very low level in absolute terms — as our Sound Level Meter will readily confirm.

You can also use our Sound Level Meter to check your hifi sound reproduction levels — are you listening at realistic or excessive levels? Many people listen at excessively high levels, particularly when in their cars or when using headphones.

If you are involved with amateur theatre productions, discos or any other public activity where sound reinforcement is required you can also use this device to check sound distribution on a precise basis rather than simply by "ear".

Our Sound Level Meter uses the "A" weighted characteristic which is selected as a compromise compensation for the reduced sensitivity of the ear to high and low frequencies, as depicted by the Fletcher-Munson curves. It is also the characteristic referred to in any legislation which specifically mentions a noise level. For example, 85dBA refers to a



Our Sound Level Meter measures sound pressure in nine ranges with fast or slow response.

sound level of 85dB using "A" weighting.

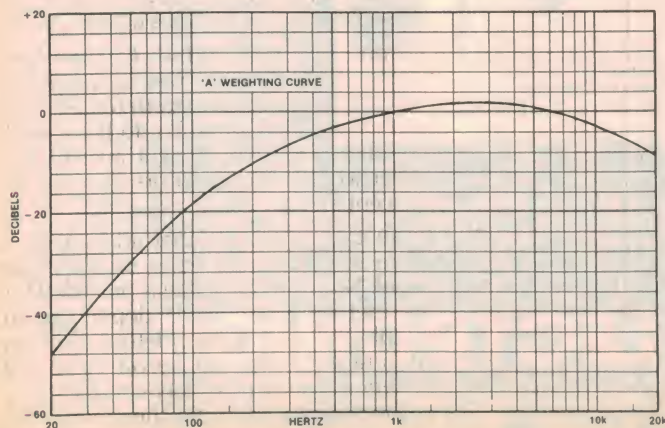
Our Sound Level Meter also features fast and slow response times. The fast response is used when you wish to monitor sounds of a percussive or transient nature while the slow response can be used to ignore the effect of an occasional transient upon the general noise level.

Overall measurement range is from less than 30dBA to slightly more than 120dBA — more than 90dB overall. 30dBA is the sort of level you would expect to (and wish to) find in an average domestic bedroom in the dead of night (discounting snores and possums in the roof). At the other end of the scale, 120dBA is unspeakably and painfully loud — to be avoided at all costs, since even brief exposure to these levels can cause permanent hearing damage.

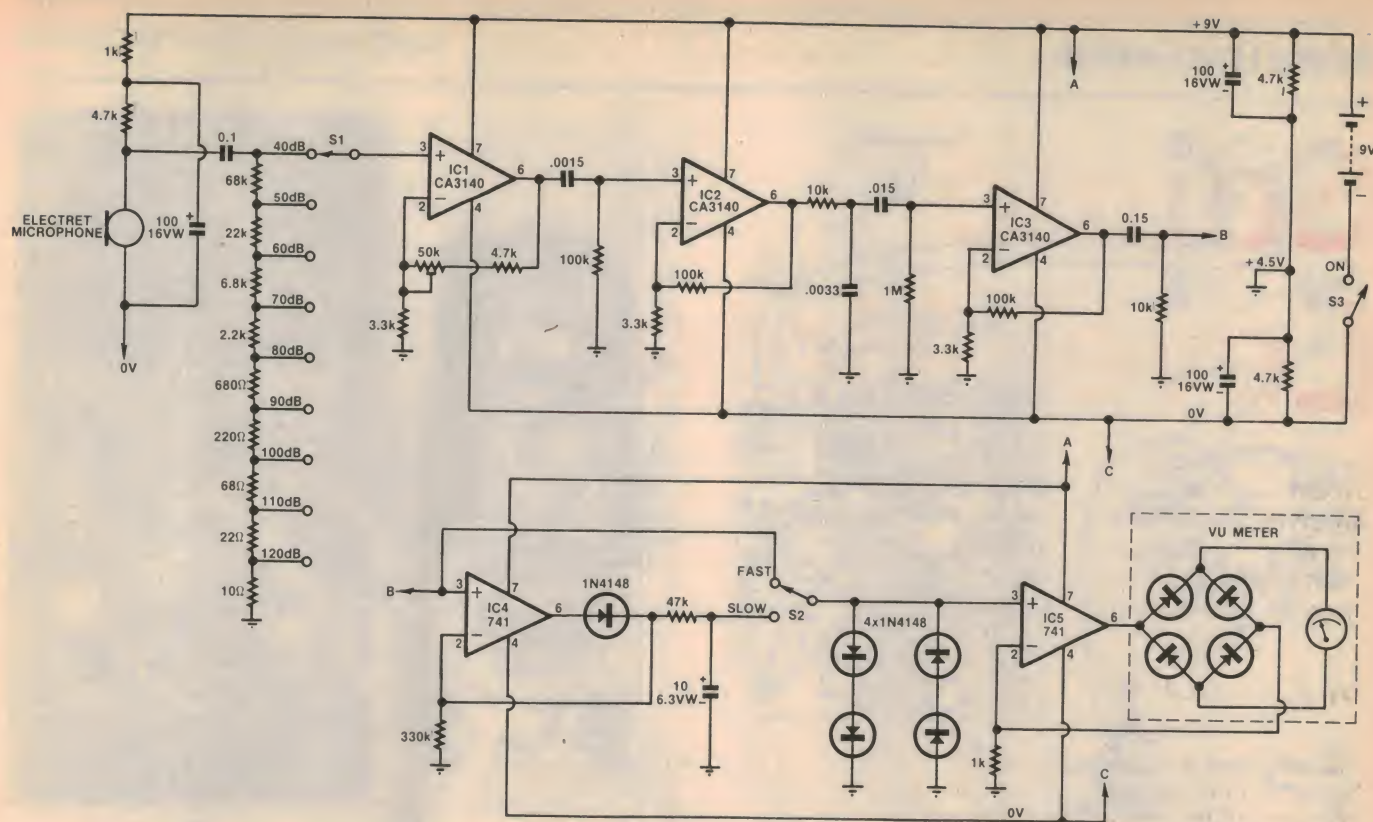
THE CIRCUIT

The key component of the Sound Level Meter is a low-cost electret microphone insert which has excellent performance in spite of its low cost.

Because electret microphones deliver



This graph shows the "A" weighting characteristic used for most sound level measurements and used by our Sound Level Meter.



7/M/

very small signals, relative to conventional high impedance dynamic microphones and because of the need to measure a very large range of sound levels, the circuit requires enormous gain. This is provided by five op amps. Three of these are the CA3140T Mosfet-input type while the other two are 741 op amps. Now let us refer to the circuit.

Each of the following CA3140T op amp stages is also a non-inverting amplifier with a fixed gain of 30dB. Note that we specifically recommend the CA3140T for this application. The "T" suffix refers to the low cost "minidip" package. Other Fet-input op amps, such as LF351 or TL071, are not suitable in this application as their minimum gain-bandwidth product is inadequate.

resistor and $.0033\mu\text{F}$ capacitor forms a 5kHz low-pass filter while the $0.15\mu\text{F}$ capacitor and $10\text{k}\Omega$ resistor following IC3 form a 100Hz high-pass filter. The additional $.015\mu\text{F}$ capacitor between IC2 and IC3 is not required for the A-weighting characteristic but to provide AC-coupling to prevent DC offset problems.

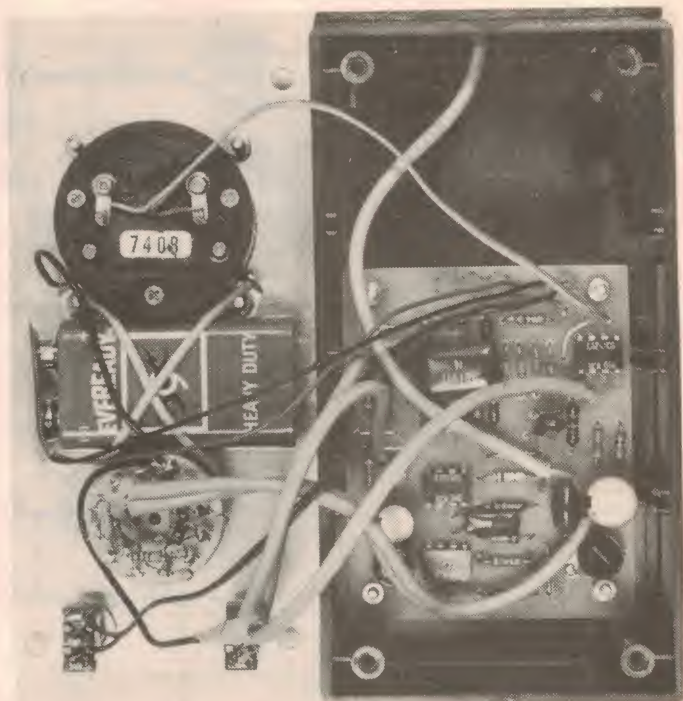
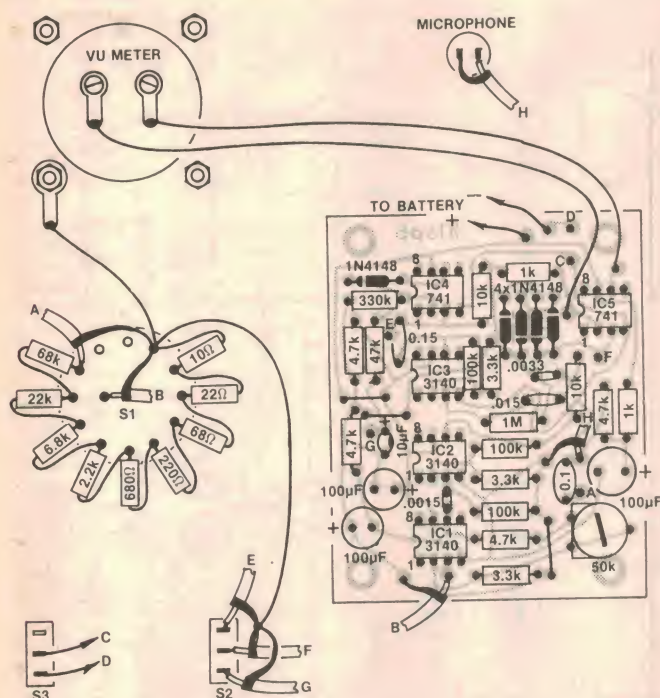
\$35

This includes sales tax and battery.

IC5 functions as a current driver for the VU meter movement which has an internal bridge rectifier. Since the meter is inside the feedback loop, the non-linearity and voltage drop of the diode network are effectively cancelled. Meter overdrive is prevented by the four diodes shunting the input to IC5.

CONSTRUCTION

Start construction by making sure the PC board will fit snugly within the box. If not, some filing of the PC board edges may be necessary to achieve this. Next, all the resistors, diodes, links and ICs can be placed and soldered in position. Follow the overlay provided to help you in the orientation and positioning of the components. Install the $0.15\mu\text{F}$ and $0.0015\mu\text{F}$ capacitors so that they lie flat on the board and do not interfere with the meter or range switch. To do this, bend the capacitor leads at right angles and solder so that the capacitors lie over the adjacent components.



The wiring diagram and inside photograph show the wiring details. The battery is secured with hookup wire as noted in the text.

meter. So the meter should be located for a close fit between the battery and switch.

The attenuating resistors can now be soldered around the 12-position rotary switch. These should be wired in a compact way and the resistor body should be inward from the switch lugs so that the effective diameter of the switch body is not increased by the resistors. The 68k Ω resistor should be between position one and two on the switch, the 22k Ω between positions two and three

following through until the 10 Ω resistor is terminated at the tenth position (even though this position is unused).

Use screened cable for the wiring to the microphone, fast/slow switch (S2) and the rotary switch (S1), as this prevents unwanted signals interfering with the sensitive amplifier circuitry. It is important to use the same earthing arrangement shown in the wiring diagram. Hookup wire can be used for the on/off switch and the wiring to the meter.

The microphone is mounted in a tapered piece of wood, which is screwed to the end of the box. This tapering ensures that little sound is reflected to interfere with the operation of the microphone output. A diagram shows the actual dimensions of the microphone holder which should be made of fine-grained wood to prevent splitting.

CALIBRATION

Calibration of the sound level meter involves either of several methods dependent upon the equipment accessible to you and the type of microphone used. Before any calibration is done, however, the zero adjust on the meter should be adjusted until the pointer reads zero with the power off. It should be noted that even at the 120dB range setting the meter will show a small reading under quiet conditions. This is due to the electronic noise within the circuit of the instrument.

The best calibration method is by using another known accurate commercial sound level meter. The two meters should be held such that the microphones are in line with a sound source and the trimpot adjusted until the same readings are obtained. Some sound level meters may not incorporate the A-weighted curve and misleading results can occur if this is not taken into account. The "safest" calibration is therefore done from a 1kHz sound source where both meters should read the same.

PARTS LIST

- 1 Printed Circuit Board coded 81sp5, 71 x 57mm
- 1 electret microphone insert, Dick Smith Cat C1160
- 1 Scotchcal front panel
- 1 Plastic Utility Box measuring 130 x 68 x 41mm
- 1 VU meter with internal bridge rectifier
- 2 SPDT miniature toggle switches
- 1 single-pole 12-way rotary switch
- 1 9V 216 Battery and clip leads
- 1 knob

SEMICONDUCTORS

- 3 CA3140T operational amplifiers
- 2 741 operational amplifiers
- 5 1N4148 signal diodes

RESISTORS (1/4W 5%)

- 1 x 1M Ω , 1 x 330k Ω , 3 x 100k Ω , 1 x 68k Ω , 1 x 47k Ω , 1 x 22k Ω , 2 x 10k Ω , 1 x

- 6.8k Ω , 4 x 4.7k Ω , 3 x 3.3k Ω , 1 x 2.2k Ω , 2 x 1k Ω , 1 x 680 Ω , 1 x 220 Ω , 1 x 10 Ω , 1 x 50k Ω horizontal mount trimpot.

CAPACITORS

- 3 100 μ F/16VW PC electrolytics
- 1 10 μ F/6.3VW PC electrolytic
- 1 0.15 μ F metallised polyester
- 1 0.1 μ F metallised polyester
- 1 .015 μ F metallised polyester
- 1 .0033 μ F metallised polyester
- 1 .0015 μ F metallised polyester

MISCELLANEOUS

Shielded cable, hook-up wire, mounting screws and nuts.

NOTE: The components specified are those used in our prototype. Higher rated components may generally be used providing they are physically compatible.

We didn't get the lion's share of the capacitor market by pussyfooting around.

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We got it by holding inventories of components running into millions of dollars and having stock available on tap in every State. — We wouldn't attempt to supply the nation with minimal stock from one central store.

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Bidirectional Interface (Short Form Kit)



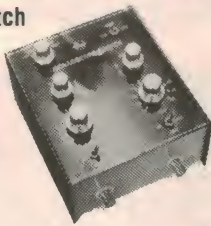
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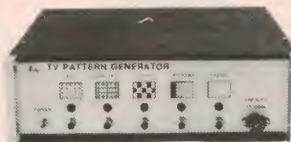
KITS

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KITS

KITS

Kit for Exidy Sorcerer EPROM Programmer to be released in August EA Kit price including Scotchcal Front Panel TV PATTERN GENERATOR
Kit of parts as featured in EA June 1980, Dot, Greyscale, Crosshatch, Raster, Check, COMPLETE KIT (incl Scotchcal front panel) \$48.49
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(see left column for details)

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Signature. EA 5/81

Alternatively, a less accurate method is to apply a signal to the microphone input with the microphone removed and adjust the trimpot until a certain reading on the meter is obtained. If the DSE microphone insert is used and a signal generator is available, then a 1kHz sine wave source at 25mV RMS is necessary to give a reading on the sound level meter of 100dB.

With the microphone out of circuit, apply the signal from the generator to the microphone input. The attenuator on the sound level meter should be set to the 100dB scale. The 50kΩ trimpot is then adjusted until the meter reads 0VU on the meter scale. That completes the calibration. Reconnect the microphone to the circuit and the sound level meter is ready to be used.

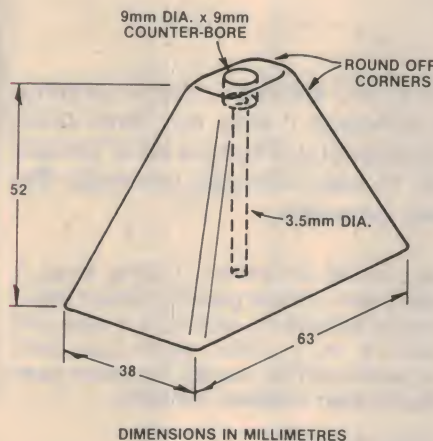
We arrived at this calibration figure by taking the mean signal sensitivity of a small sample of the DSE microphone inserts. With this calibration method it is expected that an accuracy of $\pm 3\text{dB}$ can be obtained.

Alternatively, if no signal generator is available, a signal from a low voltage

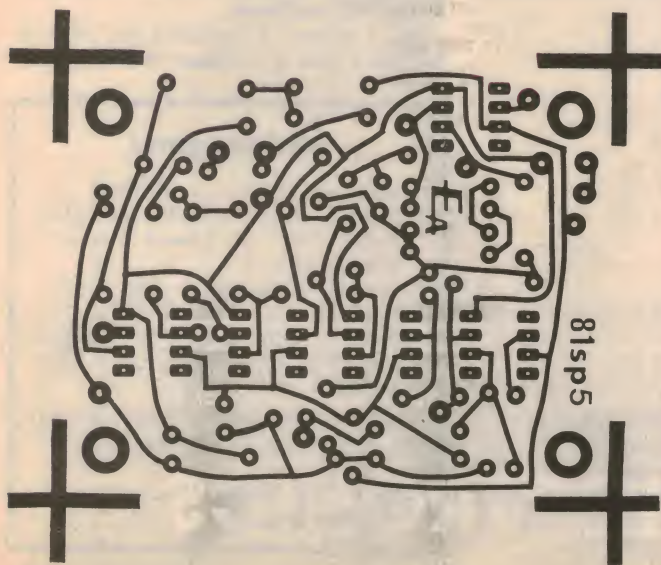
transformer can be used with an attenuator to reduce the signal level. Since the signal is not 1kHz but 50Hz, the signal will need to be 32dB greater than that of the 1kHz signal due to the A-weighting of the meter. Consequently the signal will need to be 1V RMS for a reading of 100dB on the meter.

If a different electret microphone is used, the sensitivity will be different and new calibration figures will need to be calculated. For instance, we will calculate the calibration figure required for a microphone with a sensitivity of -65dB . This is with respect to 0dB at one microbar, which is defined as 1 volt and 74dB sound pressure level. So 65dB down from 1 volt is .562mV at 74dB. A 94dB sound pressure level gives 5.62mV and at 100dB, 11.2mV. The sensitivity of the microphone used can be calculated in a similar manner.

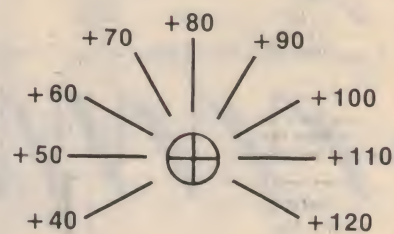
Operation of the sound level meter is straightforward. The readings are more accurate when the needle is indicating more than half scale deflection and consequently choosing the best range is important.



At left is a view of the Sound Level Meter showing how the microphone insert is recessed into the nose cone, which is shown in perspective view in the diagram above. Also shown on this page is the full-size artwork for the PC board and front panel.



EA SOUND PRESSURE METER



FAST

OFF

+ SLOW

dB

+ ON

And now ladies & gentlemen . . . the incredible all-singing, all-dancing PC Birdies

By RON DE JONG

Is it a magpie, is it a budgie? — no, it's "PC Birdies", the all-singing, all-dancing electronic canaries. But although it may not have quite the same appeal as real canaries, this project will keep a lot of people guessing. It uses just one CMOS IC to electronically generate the pleasant whistling and chirping of two canaries.

Once in a while we let our hair down at "Electronics Australia" and come up with a great little project that performs well but has no earthly use — like this one. We called it "PC Birdies", though some of the other names we came up with were "Hot Canaries", "Chirpy Chip Chip" and "Chip Chicks". Despite the awful puns embodied in these names we still think this project will really "take off".

Using just one "garden variety" CMOS IC, our project generates the realistic sound of two canaries merrily chirping and trilling away. The period of the chirping and the note of each bird is different, creating a random effect with the birds coming in an out of chorus.

If you don't have a canary already, "PC Birdies" can make an interesting addition to say an indoor garden arrangement, or as a talking point at parties or just to amuse the kids. If you do have a canary this little unit will probably give him some company and get him chirping.

An unusual application would be as an alarm for a digital clock. Rather than being woken by the harsh sound of a buzzer you can be woken to the plea-

sant sound of canaries chirping away. It also makes a great gimmick; take it into a boring lecture, or stuff it in a case and leave it in a public place (we don't recommend that you try this when passing through customs, though!).

THE CIRCUIT

Looking now at the circuit, we can see that it consists of one 74C14 hex Schmitt trigger plus a lot of resistors and capacitors, and a transistor driving an 8Ω loudspeaker. There are two quite distinct circuit sections, one for each canary sound, and each consists of three Schmitt trigger oscillators. The two sections are essentially the same except for slight component changes, so we will only discuss the operation of the section consisting of IC1a,b,c.

The three separate oscillators comprise the canary sound synthesiser: a timing oscillator, a chirp oscillator and a note oscillator. These are all Schmitt RC oscillators so before we go any further we'll look at how a Schmitt trigger functions.

Schmitt triggers have two well defined

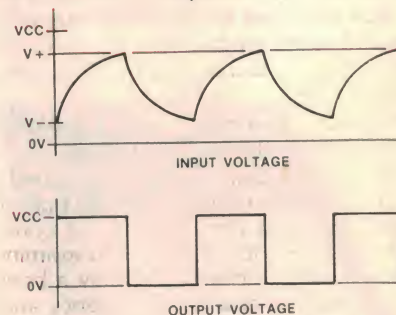
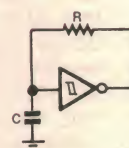


FIG. 1

trigger voltage levels, an upper trigger voltage called V_{t+} and a lower trigger voltage called V_{t-} . If the input voltage to the Schmitt exceeds the upper trigger voltage V_{t+} then the output will be low; but if the input voltage is less than the lower trigger voltage V_{t-} then the Schmitt output will be high. The only other input condition is when the input voltage is between V_{t+} and V_{t-} ; in this case the output of the Schmitt merely remains in its previous state, ie either high or low.

This effect is referred to as hysteresis and it enables us to make an extremely simple RC oscillator.

Fig. 1 shows a standard RC Schmitt oscillator plus the voltage waveforms at

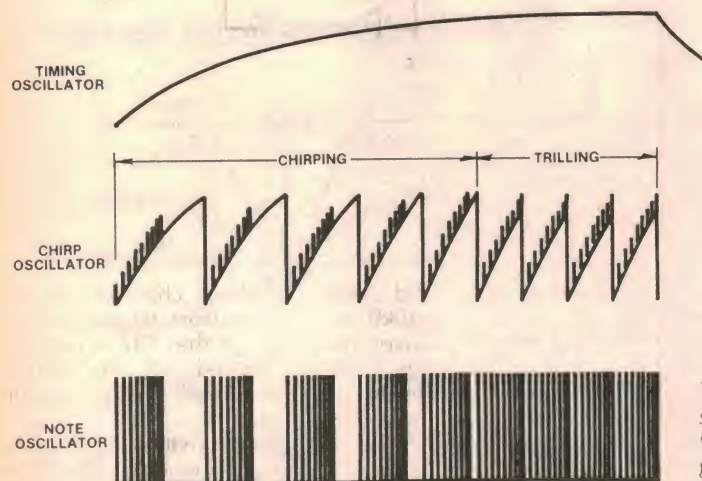


FIG. 2

This diagram shows the waveform generated by each of the Schmitt oscillators.

Bird doggerel

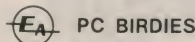
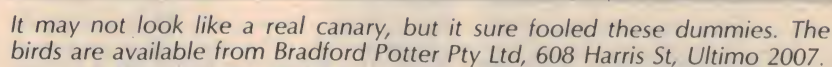
A solid-state birdie is one thing
But what can you christen the same?
"Chique chick" or "Cheap cheep" or
something,
Or maybe a "Warbling whatname"?

The term "Schmitter twitter" is clever,
"Tricky Dicky" is short and much
neater;

"Lorikeet that is Liceless" sounds nasty
But then, what about "Money Eater"?

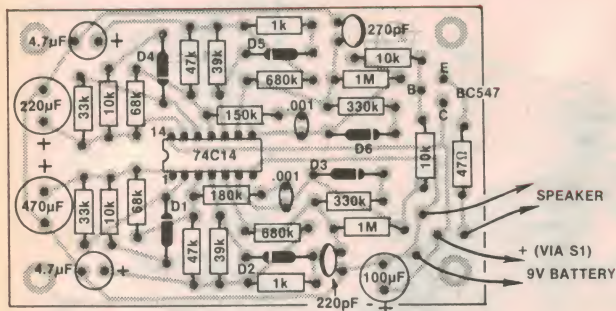
Call it "PC Birdies" . . .
And stop arguing!

This sawtooth waveform is used to bias IC1c via the 680k Ω resistor and controls the frequency of the note oscillator as follows. Assuming that we are looking at the discharge cycle of IC1c – ie the 220pF capacitor is discharging via the 1M Ω resistor – any voltage applied via the 680k Ω resistor will be added to the low output of IC1c via the 1M Ω resistor. In effect, the 1M Ω and 680k Ω resistors form a voltage divider and the 220pF capacitor will discharge down to this



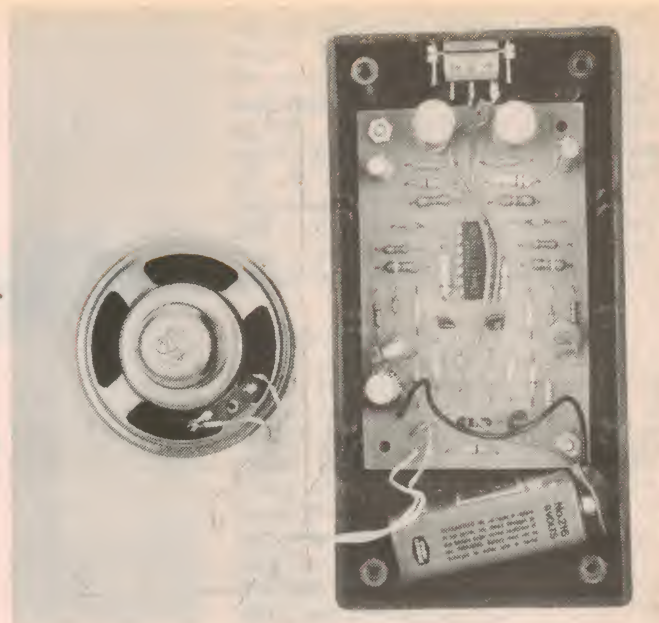
The sawtooth waveform from the chirp

PC Birdies



Above: The component overlay diagram for the PCB. Make sure that all polarised components are inserted the right way round.

RIGHT: Inside the completed prototype. A piece of foam rubber can be used to hold the battery in place.



oscillator will therefore cause the note oscillator to slide from a high to a low frequency and, because of the values we have chosen for the 680k Ω , 330k Ω and 1M Ω resistors, the note oscillator will stop at the end of each chirp. So we now have a constant sequence of chirps.

This is rather boring and not very realistic, so our next step was to vary the chirp repetition rate using timing oscillator IC1a. The repetition rate is low initially and increases until, at a certain point, the chirps are suddenly merged to give "trilling" — just like a real canary.

We used the same basic voltage controlled oscillator effect to control the frequency of the chirp oscillator. In this case, however, the bias voltage is derived from low frequency timing oscillator IC1a via a 68k Ω resistor to the input of

IC1b. The timing oscillator has a period of about eight seconds, during which the chirp rate increases and finally cuts out altogether for a few seconds. The 10k Ω and 33k Ω resistors, diode D1 and a 470 μ F electrolytic capacitor determine the frequency of the timing oscillator.

Two components we have not yet mentioned are the 180k Ω resistor and .001 μ F capacitor connected between the output of the note oscillator, pin 6 of IC1c, and the input of the chirp oscillator, pin 3 of IC1b. This circuit triggers the trilling effect and adds tremendously to the realism of the canary sound.

What happens is that when a chirp is being generated, part of the signal is coupled back to IC1b via the 180k Ω resistor and is added to the normal

charging waveform of the chirp oscillator. At the start of the timing cycle this "trill" signal has no effect on the chirp oscillator because the signal cuts out before the V_{t+} trigger voltage of IC1b is reached.

Due to the biasing effect of the timing oscillator the chirp period gets shorter but the percentage of time for which the note oscillator is enabled increases. So as the chirp period shortens we get to the stage where the superimposed trill signal causes the chirp oscillator, IC1b, to prematurely trigger, and this is the start of the trilling. When this happens, the charging voltage across the 4.7 μ F capacitor in the chirp oscillator does not go all the way to V_{t+} and in fact never gets high enough to cut the note oscillator off. Result — a rapid sequence of chirps merged together.

Operation of the other canary sound circuit is similar but we have changed some component values to give a more interesting sound effect. The reader is also free to experiment with circuit values. To give some idea of what can be done, increasing the 470 μ F capacitor in the timing oscillator will increase the period over which the chirping is repeated; decreasing the 68k Ω resistor to pin three of IC1b will cause the sound to cut out for a greater time.

The chirp period can also be reduced by reducing the 4.7 μ F capacitor, and the pitch of the chirp increased by reducing the 220pF capacitor.

Some slight differences in hysteresis

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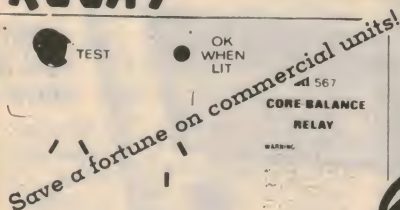
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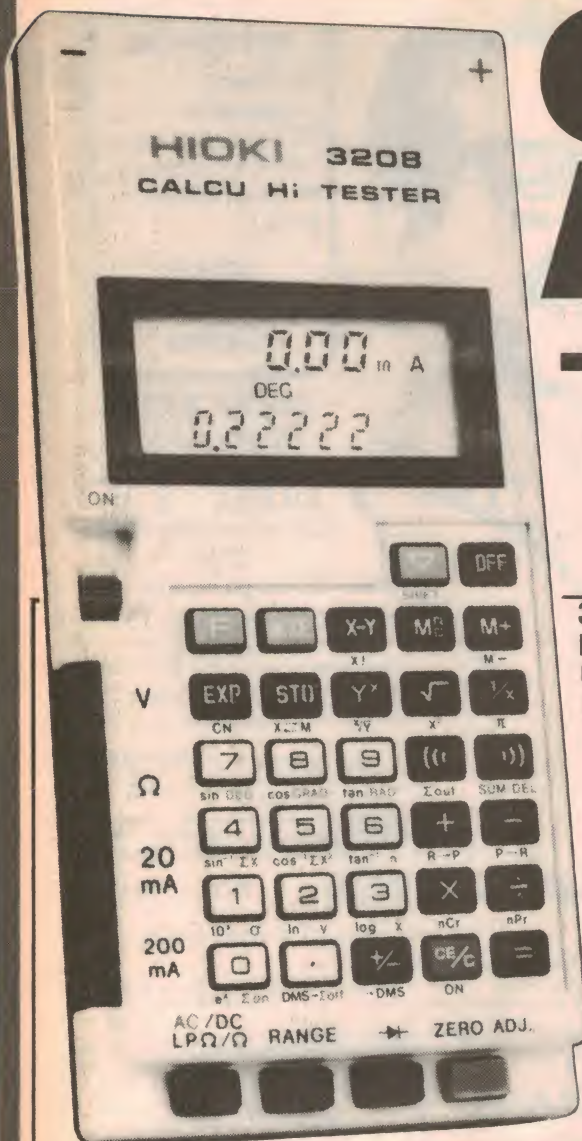
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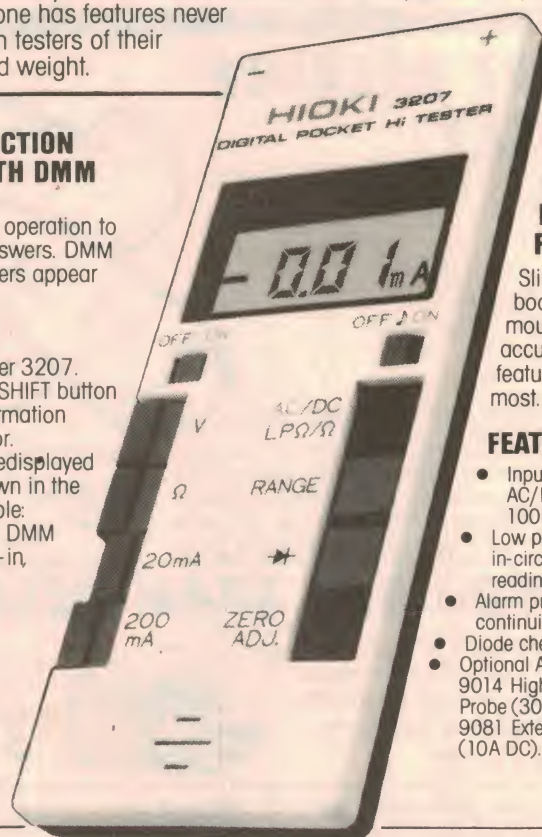


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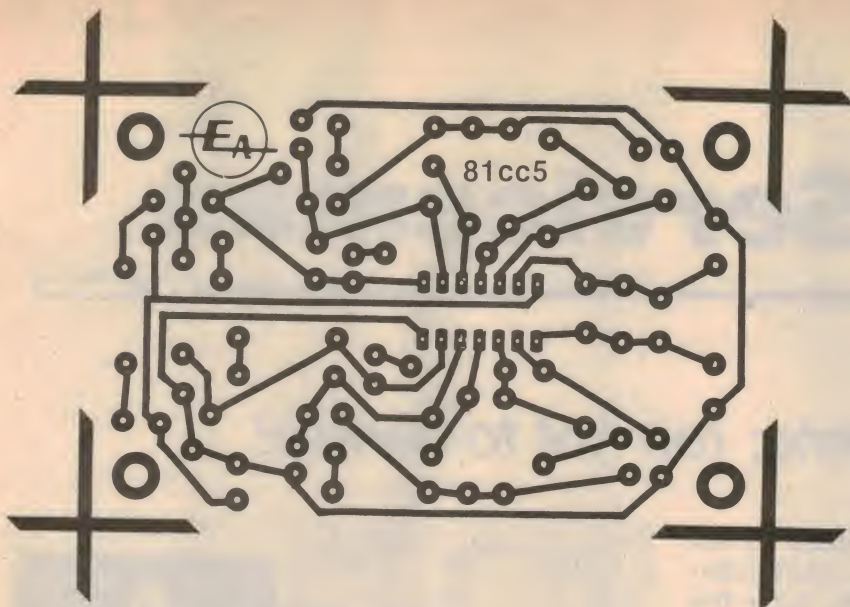
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Actual size reproduction of the PCB artwork.

voltages between various 74C14s (the quoted range is 2V to 7.2V at $V_{cc}=10V$) will cause variations in the performance of the trilling circuit. So the reader may have to initially experiment with a suitable value for the 180k Ω and 150k Ω resistors in each circuit. If the resistor value is increased, trilling will occur later or perhaps not at all, whereas if it is decreased trilling will occur sooner and last for a longer time. To simplify this procedure we suggest that you only have one circuit connected to the speaker at a time.

Outputs from both circuits are mixed via two 10k Ω resistors and applied to an emitter-follower circuit consisting of a BC547 transistor. The speaker forms the emitter load and the 47 Ω resistor limits the sound output to a tolerable level. If desired, the 47 Ω resistor can be reduced to increase the volume, although this will also increase the current consumption.

The whole circuit is powered from a single 9V transistor battery and current consumption is about 10mA. The circuit works just as well at lower supply voltages, though the resistors in the trill circuit may have to be adjusted.

CONSTRUCTION

Construction of the unit is straightforward. All components with the exception of the speaker, battery and on/off switch are mounted on a printed circuit board (PCB) measuring 89x56mm and coded 81cc5.

Commence construction by mounting the various components on the PCB according to the component overlay diagram. Fit the resistors and capacitors first, followed by the diodes and the transistor. Make sure that all polarised components are correctly oriented and that the resistors values are correct.

The 74C14 IC is a CMOS device and should be left till last. Take the usual precautions to protect against damage

PARTS LIST

- 1 zippy box, 130x68x41mm
- 1 PC board, code 81cc5, 89 x 56mm
- 1 57mm 8 Ω loudspeaker
- 1 miniature SPDT switch
- 1 9V battery, Eveready 216 etc
- 1 battery clip to suit
- 1 74C14 CMOS hex Schmitt trigger
- 1 BC547 NPN transistor
- 6 1N4148 diodes
- 1 470 μ F 16VW PC electrolytic capacitor
- 1 220 μ F 16VW PC electrolytic capacitor
- 1 100 μ F 16VW PC electrolytic capacitor
- 2 4.7 μ F 16VW PC electrolytic capacitors
- 2 .001 μ F greencap capacitors
- 1 270pF ceramic capacitor
- 1 220pF ceramic capacitor

RESISTORS (all 1/4W, five per cent):

- 2x1M Ω , 2x680k Ω , 2x330k Ω , 1x180k Ω , 1x150k Ω , 2x68k Ω , 2x47k Ω , 2x39k Ω , 2x33k Ω , 4x10k Ω , 2x1k Ω , 1x47 Ω .

from static electricity; connect the soldering iron barrel to the earth track of the PCB using a clip lead, and solder the supply pins (7 and 14) first.

We mounted the assembled PCB inside a small plastic zippy box measuring 130x68x41mm. You will need to drill holes in the case to mount the board and to accept the on/off switch, as shown in the photographs. Additional holes are drilled in the aluminium lid to provide a grille for the loudspeaker, which is glued in position using epoxy adhesive.

With construction completed, you are now ready to unleash the unit on your friends and an unsuspecting public. Have fun!

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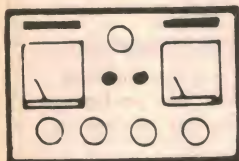
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The Serviceman

A country TV antenna: too hot to handle!

Television antennas in metropolitan areas do not usually warrant much comment and, unfortunately, are often treated as an afterthought. But in the fringe areas it is a different matter; the antenna is often the major part of the installation, with the set tacked on the end of it, rather than the other way round.

In my suburban stamping ground there are seldom many traumas or complications involving customers' antennas. Even when people move, they usually leave their old antenna behind and simply accept whatever they find in their new location.

But not so out in the fringe areas, where the following story originated. More precisely, it comes from a colleague on the south coast of NSW.

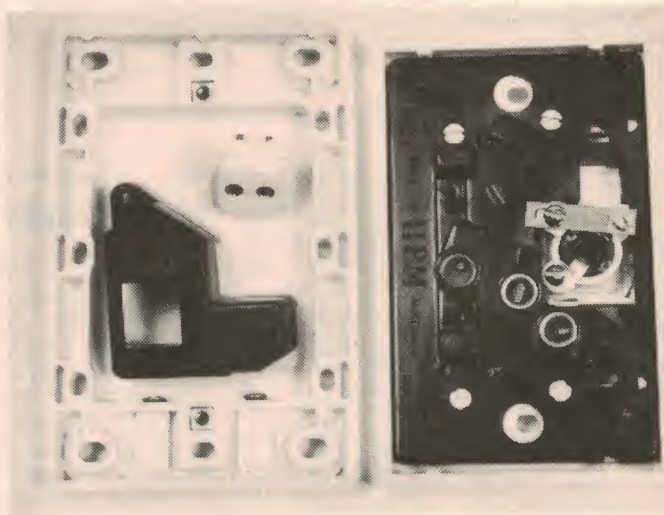
The area involved has its own regional TV stations; a commercial station on channel 4 and ABC station on channel 5A. In theory, the residents are supposed to be content with this service but, human nature being what it is, there are many who hanker for the choice of the Sydney stations as well. They are prepared to spend a lot of money on elaborate antennas, mast head amplifiers, etc, for even a few days reception a week.

So much for the background. The story is really third hand, having been related to my colleague by one of his colleagues, if you follow me! I mention this because, at this distance, some precise details may not be clear, even though the overall implications are only too apparent.

It concerns a customer who was having a new home built and approached the serviceman to have his elaborate phased array, splitter, and two-outlet system transferred to the new building when he was ready to move in.

The serviceman was quite happy to do this, but decided to leave some of the work to the electrician who was doing the house wiring. It was a logical time to do the work, particularly as it was a double brick house, and it would save the technician a journey at what might be an inconvenient time.

A typical combination power point and TV outlet. On the right is a rear view. On the left, a spacer plate, alternative TV connector and the rear safety cover.



So the electrician was issued with coax cable, the splitter, and instructions as to where the points were to go and how everything was to be connected. He would leave a suitable length of cable emerging from the roof for connection to the antenna.

The two outlets were to be combined with two power points, using the combination power point and TV outlet plates which are now quite popular. All in all, it appeared to be a perfectly routine assignment.

ALL FINE AND ... YEOW!

Subsequently the electrician completed the work and the supply authority inspected it, passed it, and connected it to the mains. The customer then moved in and called on the serviceman to complete the installation. And, in the rather free and easy manner of the country, he offered to give the serviceman a hand.

So the serviceman mounted a couple of brackets on the brick wall, fastened the antenna to a three metre length of metal pipe, and took this assembly onto the roof. The idea was that he would connect the coax to the antenna, then lower the mast over the edge of the roof to the customer on the ladder. The customer would then secure it to the lower bracket while the technician supported it.

The technician duly connected the coax, then lay down on the roof to lower the mast to the customer. At this point his other arm came in contact with the gutter and, in his own words, "... received an almighty wallop." Fortunately the muscular reaction threw his arm clear, breaking the circuit, while he instinctively dropped the antenna and mast. (Its ultimate fate is not recorded.)

When he had recovered sufficiently, he checked the situation with a multimeter. Sure enough, as he suspected, there was 240V AC on the antenna. At this point the customer called the electrician who, on being told what had happened, was extremely skeptical. However, he came around immediately, and was horrified when the situation was confirmed.

How had it happened? To understand this, it is necessary to look more closely at both the combination antenna/power point and how it was fitted. Looking at the power point it would appear to be virtually impossible for the two cables to make contact. Apart from the insulation on each, the power point is fitted with a screw-on cover which completely encloses the three mains terminals. There is just no way the coax could touch them.

The whole assembly measures about 32mm deep from the back of the plate. Allowing for about 8mm for the plaster,

it needs another 25mm clearance behind the plaster. With double brick construction the electrician has two choices. If he wishes to mount the plate flush with the plaster it is necessary to chip away a substantial portion of brick, leaving a clear opening into the cavity.

A cheaper alternative is to simply drill a hole through the brick for the cables, then mount the plate on a plastic backing box about 25mm deep, so that the plate sits proud of the plaster. A variation on this theme is to use a shallower backing box, about 10mm, and to chisel a shallow recess in the brick. It was this latter method that the electrician used in this case.

Unfortunately, he had chosen to take out only a bare minimum of brick, and then had further compromised by omitting the safety cover mentioned above. This cover adds some 19mm to the depth of the assembly so, by leaving it off, he saved himself a good deal of brick chipping.

The result was that the cables were crushed between the power point and the brick. The exact point of contact between the mains active and the coax braid is not known, although it is known that the black coax sheath was retained right up to the socket. So something sharp must have penetrated the sheath under pressure.

The electrician had no option but to correct the fault and what could have been a tragedy ended happily enough, even if no one was laughing! In fact, the incident raises a number of very pertinent questions — to which I confess I don't have the answers.

RESPONSIBILITY?

Whose responsibility was it to see that this situation did not happen? For the most part it was undoubtedly the electrician's. Omitting the safety cover, may well amount almost to culpable negligence, yet it appears to be common practice. My colleague quizzed a number of electricians on the subject and all gave essentially the same answer, best summarised by one of them, "Aw, nobody uses those covers — they're a bloody nuisance!"

But he is not the only one who had a responsibility. If only for his own sake, the serviceman should have checked the cable before he handled it. In fact, my colleague insists that he never trusts any cable which he has not installed himself; he claims that, over the years, he has encountered a number of cases of apparently innocent cables which have somehow become tangled up with the mains.

And what about the makers of the power point? Is the concept open to query? The very same electricians, who insisted that the cover was never used, described the power points by several unprintable names, the most polite remark being that they should be banned.

Yet it seems to me that the design is basically safe. The only criticism appears to be that it allows the user to take a short cut and save time at the expense of safety. Whether the blame for that rests with the manufacturers is highly debatable.

But the really curly question concerns the supply authority. Where does their responsibility begin and end? Should they have insisted on being advised about all the work the electricians had done? And should they have checked the TV coax as well as the house wiring? Should they have checked to see whether the safety cover had been fitted?

I don't pretend to know the answers, but I do have a friend who works in one of the larger metropolitan county councils, and I put the question to him. He, in turn, passed it on to a colleague higher up in the organisation.

OFFICIAL REACTION

His reaction was one of both horror and surprise; horror because an innocent person had come so close to being killed, and surprise because, apparently, neither he nor the rest of the organisation had ever heard of, or even thought about, a fault of this kind.

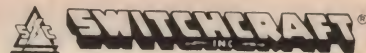
In fact they were anxious to get as many details of the incident as possible, in order that it could be listed among potentially dangerous situations which are reviewed by various safety committees from time to time. Ultimately, such an incident could result in a change to the wiring rules, the design of a fitting, or both.

On the question of responsibility he was fairly definite. Legally, a power supply authority could not be held responsible for such a situation. It would be economically impossible to physically inspect every part of an installation in a search for subtle faults which may not show up on the usual megger and similar tests.

Basically, the responsibility rests with the electrician. He is expected to follow the wiring rules, in the spirit as well as the letter, exhibit a high standard of workmanship, and use his commonsense if there is any question of safety.

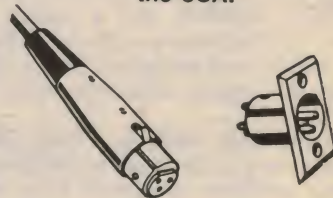
On the other hand, the council inspector would be expected to use some commonsense also. When inspecting any new installation, it is usual to undo and inspect the rear of at least one power point, in order to check the general standard of workmanship. And in a case like this, the logical one to check would be the one with the TV outlet.

And finally, one last horrible thought. Had the serviceman not discovered it, and assuming a TV set with DC isolated antenna terminals, it would have been possible for the antenna to be erected without anyone knowing it was alive. That is, until some child, retrieving a lost

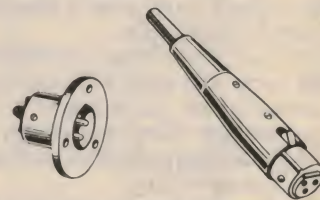


CONNECTORS & ELECTRONIC COMPONENTS

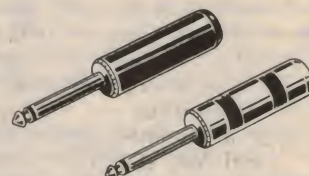
Superb quality and reliability from one of the oldest and most experienced manufacturers in the USA.



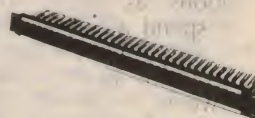
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THE SERVICEMAN — continued

ball from the roof, grasped the gutter in one hand and the TV mast in the other

A second antenna story comes direct from my colleague. It concerns an elaborate antenna installation which he had provided for a customer about five years earlier; a high-gain phased array, mast head amplifier, and a couple of splitters. The location is one of the best in the district and reception of the city channels is virtually snow-free most of the time.

That is, until recently. Then the customer rang up and rather diffidently enquired whether reception from the city stations had suffered for any reason, since he did not seem to be getting as good a reception as previously. My colleague replied that he had not had any other complaints but suggested that the customer check it out over a few more days, then let him know.

In fact, it was about three weeks before he rang back, and even then his report was inconclusive; sometimes it was good, sometimes there was hardly any signal. My colleague decided that an inspection was called for.

On switching on the set and checking the Sydney channels he was immediately aware that the performance was a long way down on what he expected, even if conditions were at their worst. But the first clue came when he switched to a local channel. The signal was strong enough, but there was definite evidence of hum on the picture.

This immediately threw suspicion on the mast head amplifier. While normally a very reliable brand, he had experienced a few cases where the smoothing capacitor in the power supply had dried out, causing these very symptoms.

In fact, the symptoms were so classic that my colleague decided that the quickest and cheapest way out of the problem was to fit an exchange mast head amplifier. Not having one with him, he arranged to return later in the day and do the job.

NOT THE PROBLEM

When he did it was to be reminded that the amplifier was so located that it required a major balancing act on the roof to remove it and fit the new one. But it was eventually done and he hurried down to the set for the big switch-on. Alas for his hopes; the performance was not one whit better, with the hum just as obvious as before.

So now what? The next suspect was the small power supply which feeds AC up the coax to the amplifier. A check showed only about eight volts across the line, instead of the 25V or so normally present. Disconnecting the coax from the power supply restored the 25V.

So it looked as though the coax was loading the power supply. A resistance

check was made, but proved inconclusive. The resistance was somewhat lower than normal, but nowhere near low enough to produce the drastic voltage drop which was occurring.

So was it the power supply? Did it have a high internal resistance due to some fault? That question was quickly answered by fitting a second power supply — which behaved exactly the same as the first.

It was now obvious that the trouble, whatever it was, was more likely to be found at the antenna end of the line than the set end. And, to avoid another balancing act, it was decided to fetch a ladder and lower the mast so that the amplifier and antenna could be reached comfortably from the roof.

Then my colleague disconnected the coax from the amplifier, went back down to the set, and checked the voltage at the power supply. It came as something of a shock to find that there was still only around eight volts on the cable.

CABLE FAULT?

The next step was to disconnect the coax from the power supply, whereupon the power supply voltage rose to normal. So he made another resistance measurement across the cable, and this time obtained a much more likely reading, around 500 ohms. While still mystified as to why he had not obtained this reading before, he was now sure

*"Mmmm . . .
nothing for it
but to put in a
service call!"*

But why? Closer examination of the coax at the amplifier end provided the clue. Some small pieces of the outer sheath were missing and my colleague immediately wanted to know whether the customer had been visited by the galahs which are common in the district. In fact, it seemed that they were frequent visitors and usually sat on the antenna.

The final test was to cut off about 30cm of cable, whereupon the water literally poured out. By damaging the outer sheath the galahs had provided an entry point for water whenever it rained and,

that the coax was at fault.

while there might not have been much getting in each time, the effect had been cumulative, probably over several years.

The cure was obvious; fit a new length of coax, using the old coax as a draw wire to pull the new length through the wall cavity. And when the old coax was examined more closely it was discovered that the water had penetrated its entire length. Then my colleague remembered that when he had first disconnected the coax from the power supply, he had noticed a small spot of verdigris at the termination point.

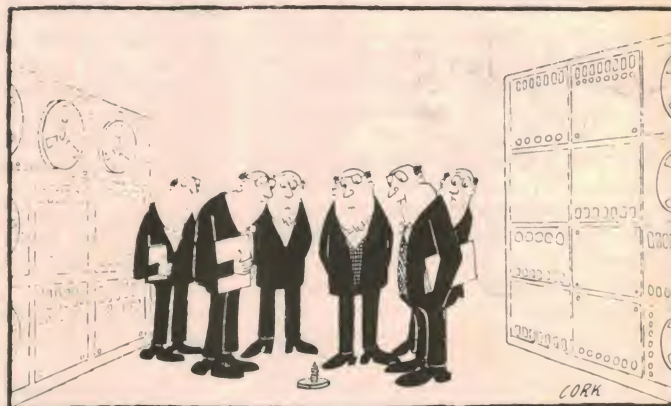
THOSE MULTIMETERS!

And why had my colleague's first resistance measurement shown such a high value? He is still not certain, but he suspects his multimeter. It is a modern all-singing, all-dancing, digital variety which, in all other respects, has proved itself an ideal unit, to the point where he is considering buying a second one.

But it has one weakness; its ohms ranges are extremely sensitive to spurious voltages, even quite small ones, which might be present across the circuit under test. This would not be the first time that he had obtained a false resistance reading from such a cause.

The exact source of a spurious voltage, if there was one, is not definite. The most likely explanation is electrolytic action due to dissimilar metals, such as the copper coax braid and its earthing point at the mast head amplifier.

Anyway, whatever the cause, it would seem to provide some ammunition for those who claim that modern digital



multimeters are not the answer to the serviceman's prayer which the makers would have us believe. (Forum, p24, March, 1981.)

On the other hand, I vividly remember the Readrite meters and similar crude devices of the bad old days, which the Editor-in-Chief mentioned. And even as late as the 1950s we were still at the mercy of the moulded mud resistors which served as multipliers; devices which could drift several per cent in as many weeks. The modern devices may be more accurate than necessary but I, for one, don't find this a disadvantage. ☺

SONY



Heavy.

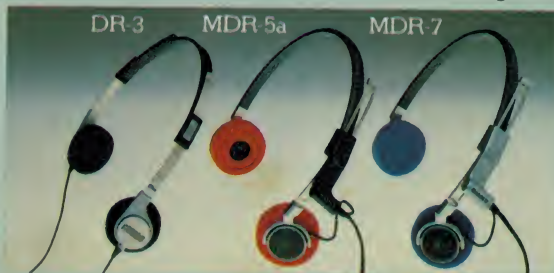
Introducing another Sony only. The MDR series open-air headphones. The smallest, lightest stereo headphones available today. Or tomorrow.

With our lightest at 40 grams, you will barely know you're wearing them. Yet the sound is dynamite.

Through a remarkable new audio breakthrough, our engineers have succeeded in reducing big-headphone technology down to the size of your listening channels.

The MDR series headphones' airy spaciousness delivers absolute clarity through an ultra-small driver

unit that produces more than three times the energy of conventional circuits. And a new high-compliance diaphragm accurately reproduces the 20 to 20,000Hz bandwidth and improves low-range response.



That means you can listen to the heaviest of music for hours. Lightly. And know that you're hearing every nuance of the original recording from deep bass to the highest treble.

Listen to our new MDR series headphones. They're light. And heavy.

STEREO HEADPHONES
MDR

A Technics SL10 turntable is shown floating in the air, tilted at an angle. The turntable's platter is black with a white curved line and a small white rectangular block. The tonearm is yellow and curved. The control panel is white with several buttons and a scale. The background is a field of purple flowers under a blue sky with clouds.

Product of a sup

Introducing the futuristic SL10, Technics' new quartz-locked, AC/DC, direct-drive turntable. Unlike conventional turntables, the SL10 has an electronically-controlled linear tracking arm that doesn't depend on gravity to track a record. All contact with a record is controlled by microcomputer, so the SL10 plays perfectly at any angle—even upside down.

The precise tracking arm control is designed to extract the maximum amount of musical detail from your records.



errior intelligence.

It's the kind of innovative thinking you expect from Technics—who introduced the world's first direct-drive turntable 10 years ago. And yet all this sophisticated technology is contained in a piece of equipment the same width and depth as an LP cover.

The SL10 is part of the highly advanced Technics range. See it at better hi-fi stockists.

We're sure you'll agree it's definitely the product of
a superior intelligence.

Technics
National Panasonic (Australia) Pty Ltd

Expanding the music experience.

Dailey/NPA21



Sound safe.

Agfa SUPERFERRO—the sound safe—will record and store your music safe in sound, ready for when you want it. And we mean all the music. The outstanding performance of Agfa SUPERFERRO is achieved through the use of a particular form of ferric oxide particle that is uniform in shape and size. The second factor is an Agfa technique that enables more particles to be deposited per sq. mm of tape, with each particle separated and in line to eliminate cross-over interference.

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1. Reduced background noise.
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3. Improved dynamic range.
4. Improved high frequency output level.

5. Reduced harmonic distortion. In addition, Agfa SUPERFERRO cassettes feature a special mechanism for improved running properties.

Agfa SUPERFERRO—the sound safe you can bank on for outstanding performance.



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CIRCUIT & DESIGN IDEAS

We invite readers to submit circuit ideas and solutions to design problems. Explain briefly but thoroughly the circuit's operating principle and purpose. Sources of material must be acknowledged and will be paid for if used. As these items have not necessarily been tested in our laboratory, responsibility cannot be accepted.

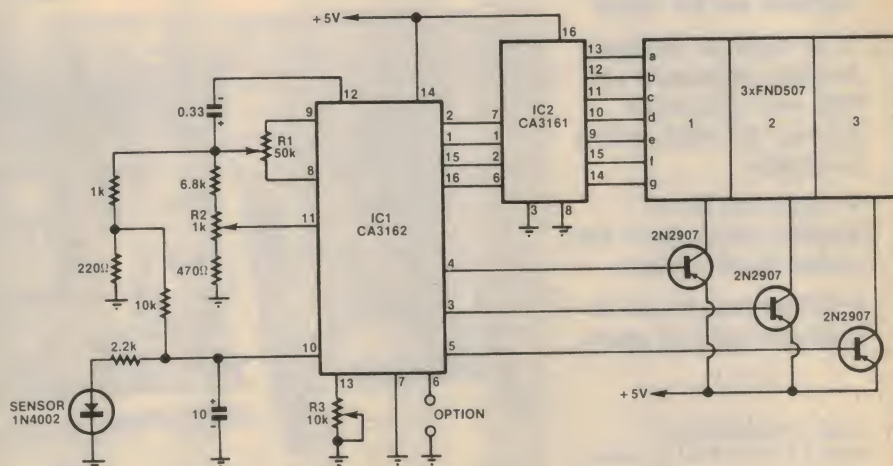
Electronic Thermometer with Digital Display

Using a 1N4002 diode as the temperature sensor, this instrument provides a three-digit display of temperature. When current flows through a silicon junction (eg diode), the voltage drop across the diode varies inversely to the junction temperature. Making use of this well-known fact, the instantaneous voltage across the diode is applied to the input of IC1 (CA3162), a dual slope/dual speed BCD encoder.

The encoded signals from IC1 are coupled to IC2 (CA3161), a seven-segment decoder/driver which feeds the three seven-segment LED readouts, each of whose segments is connected in parallel with each of the others. Three supplementary "decade" outputs from IC1 feed three PNP transistor switches, each of which controls the power supply to one of the three seven-segment displays.

Setting-up procedure is relatively simple, bearing in mind that R1 is the ZERO adjuster, R2 the LOW temp adjuster and R3 is the HIGH temp adjuster. Proceed as follows:

i. Ground pins 10 and 11 of IC1



- ii. Adjust R1 so that display shows "000"
- iii. Remove ground from IC1
- iv. Put diode probe in iced water (more ice than water)
- v. Wait five minutes, then adjust R2 for display of "032"
- vi. Repeat in boiling water, and set display to "212" with R3.

As there may be slight interaction between presets, repeat the above sequence at least once. If it is desired to change the "update" frequency, jumper pin 6 to 7 of IC1.
D. Mills, Paeroa, North Island, New Zealand.

Analog Memory

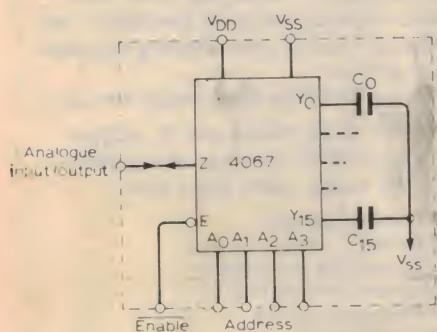


Fig. 1

The 16-channel multiplexer in Fig. 1 is connected to an array of capacitors to form an analog memory which functions in a similar way to a conventional RAM. Each sampling capacitor stores a charge which is dependent on the analog input. Storage time is limited by the capacitor size, leakage current and permissible drift. With 1000pF capacitors the decay time is several hundred milliseconds.

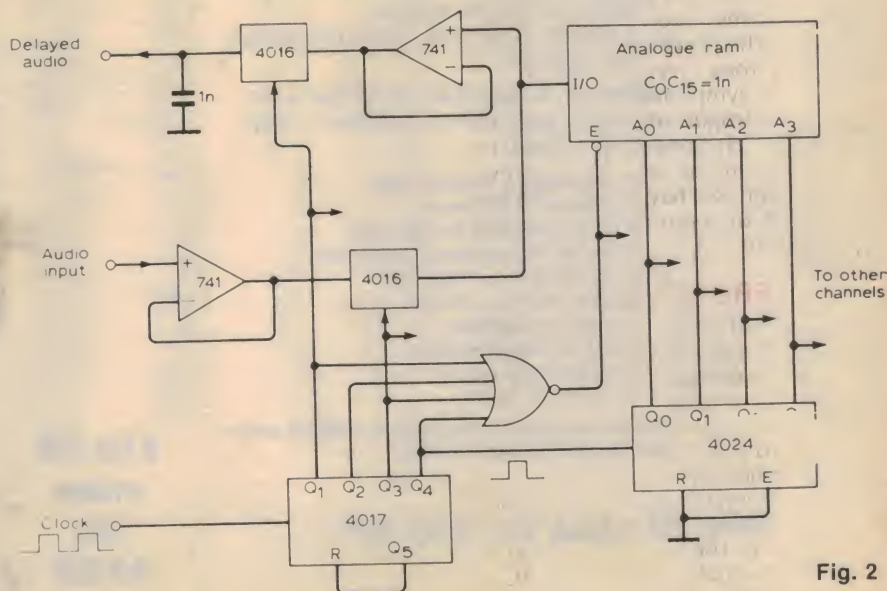


Fig. 2

One application of this circuit is for variable audio delay as shown in Fig. 2. With a sampling rate of 50kHz the delay is approximately 320μs, but this can be changed by altering the frequency. The

memory is used in a read-before-write mode and effectively forms a serial shift register.
From Wireless World, December, 1979.

HOBBY-BLOX™

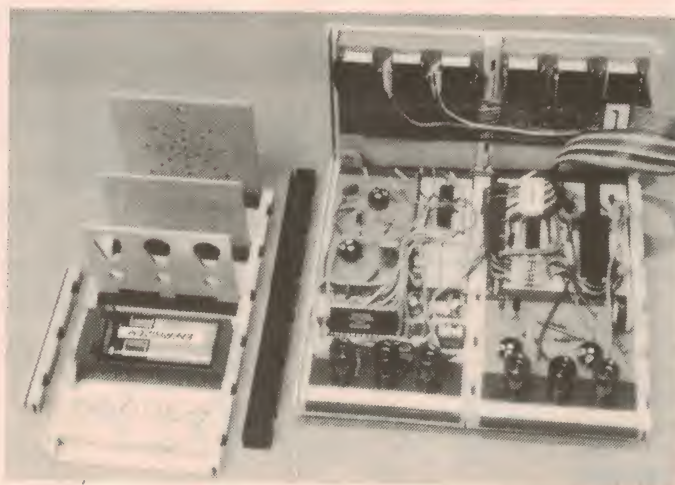
The new modular circuit building system designed especially for electronic hobbyists.

• *Hobby-Blox™ is the new total bread boarding system for the beginners, hobbyists and the expert.*

• *14 separate modules.* Available individually and fully inter-changeable allowing the whole system to expand.*

• *Solderless bread-boarding saves time – the answer for prototypes.*

• *All components can be used over and over again.*



• *Solderless modular system – select only required parts. More economical than "professional" boards.*

• *Colour coding plus letter/number indexing speeds component layout.*

• *Core of the Hobby-Blox™ system are two starter packs – one for discrete component projects, one for integrated circuits. Each comes with complete instructions for building TEN projects.*

* See advertisement in April E.A. for complete listing of modules.

DISCRETE COMPONENT STARTER PACK 921480



Contains:

- 1 tray – the basis of the entire system – into which all modules fit easily.
- 1 discrete component strip – 14 terminals each with 5 tie-points on 0.2" grid. Staggered rows make insertion of larger components easy.
- 1 battery holder and connector (battery not included).

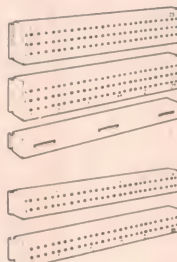
Instruction Book covers ten projects for only \$4.72 worth of components – that's 47¢ per project!

1. Monostable Multivibrator
2. Astable Multivibrator
3. Light Activated Multivibrator
4. CMOS Monostable Multivibrator
5. NAND gate and AND gate
6. Basic Memory Circuit
7. Buffered Flip-Flop
8. Liquid-Level Detectors
9. Sequence Generator
10. Coin-Flip Game

NB. All required components are available under part number 921591 at \$4.72.

\$11.72 value for \$10.20

INTEGRATED CIRCUIT – STARTER PACK 921490



Contains:

- 2 terminal strips – 26 x 3 tie-point terminals accept a wide variety of discrete components and all DIP sizes – lead sizes 0.015" to 0.032".
- 1 spacer/support strip – when terminal strips are side by side spacing is 0.3". Insert the spacer between them and row to row spacing is 0.6".
- 2 distribution strips – each has two continuous 26 tie-point terminals – so easy to connect your circuitry to power and ground.
- 1 tray – modules fitted ready for use.

Instruction Book covers ten I.C. projects using only \$10.76 worth of components – that's just over a dollar per project!

1. Transistor Switch
2. Delayed Transistor Switch
3. Monostable Multivibrator
4. Astable Multivibrator
5. Time Delay Switch
6. Status Indicator
7. Radio Signal Injector
8. Transistor and Gate
9. Transistor or Gate
10. Memory Cell

NB. All required components are available under part number 9211592 at \$10.76

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MAIL ORDER: Add \$1.50 to order value for post and packing. Send cheque mail order to Xenitek Pty. Ltd., P.O. Box 128 Brookvale 2100. Or write for FREE CATALOGUE. Available from:

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XENITEK

Converting the electronic music box to pushbutton operation

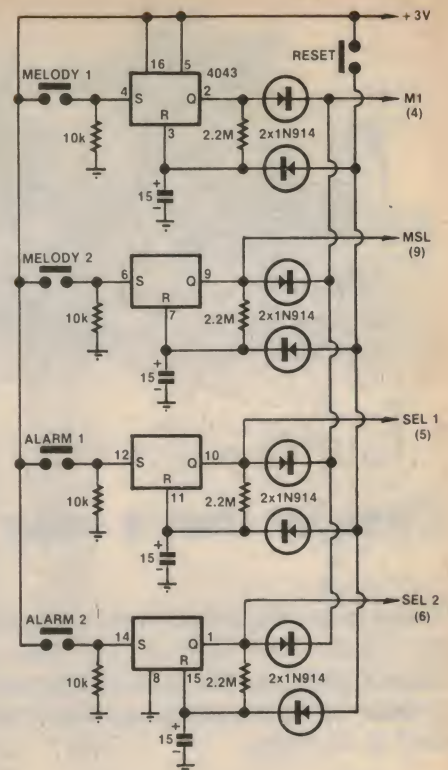
A modification to the Electronic Music Box described in the December 1980 issue of EA enables each of the programmed tunes/alarms to be selected with individual momentary-contact pushbuttons. Simple timing networks provide about 30 seconds of playing time. With this modification the complete unit becomes very suitable for use as a musical doorbell. In addition, a master reset button provides for simultaneously resetting all inputs and inhibits further triggering of any tune for approximately 30 seconds. This discourages children from continually playing with doorbell buttons.

The circuit consists of a 4043 quad R/S latch with the Q output of each latch enabling the appropriate "select" input of the 7910 Melody Generator. Each

pushbutton triggers the latch by applying a momentary HIGH to its SET input. A $2.2\text{M}\Omega$ resistor connected from the Q output to the RESET input charges a $15\mu\text{F}$ capacitor so that after approx 30 seconds the latch is reset, with Q reverting to low.

A similar 30 second period must elapse for the capacitor to discharge through the $2.2\text{M}\Omega$ resistor, after which the RESET input reverts to a low. During this period the latch cannot be retriggered. Four diode gates enable simultaneous resetting of the four flipflops by the master reset button, with all SET inputs being simultaneously inhibited for the aforementioned 30 seconds.

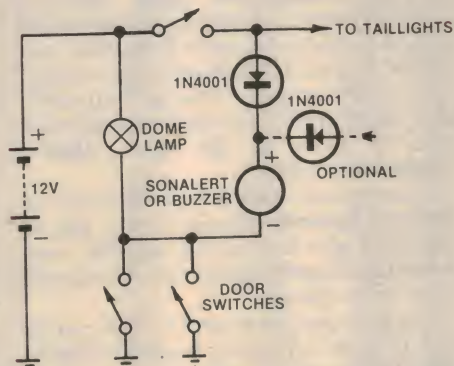
(J. Schofield,
St Agnes, SA.)



Simple head/parking light reminder alarm

Applicable to those cars where the door switches connect the dome lamp circuit to the chassis, this simple alarm sounds whenever the headlights are switched on and a door is opened. It is muted when either the headlights are switched off, or the door is closed.

The only components required are a diode — and a buzzer or Sonalert. If the lights are ON, and a door is opened, current flows through the diode, buzzer and door switch to chassis, producing an audible alarm. Note that as soon as either the lights are turned OFF or the door closed, the circuit is interrupted and the warning ceases.



Since the circuit is non-latching, it may be wired to the taillight circuit thus providing

reminder alarm protection for either head or parking lights. Note that it is still possible to park and lock the car with the tail/parking lights alight, since the alarm only sounds whilst a door is open and will be muted when the door is closed. A further variation would be to incorporate an additional diode at the junction of the original diode and the buzzer thus creating an "OR" gate which could be connected to any other of the vehicle's circuits where alarm protection is desired.

(R. G. Adams,
Melville,
New Zealand.)

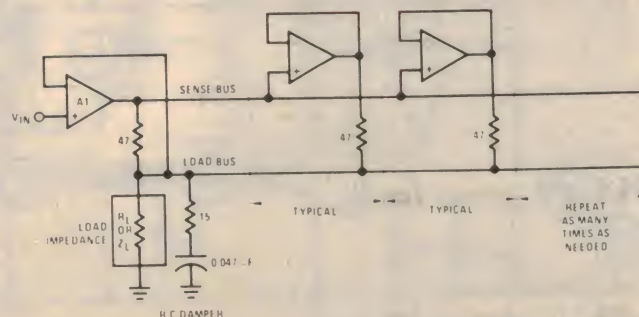
Obtaining more power from dual or quad op amps

National Semiconductor Corporation suggests the accompanying circuit for driving large currents into resistive, reactive, nonlinear, passive or active loads.

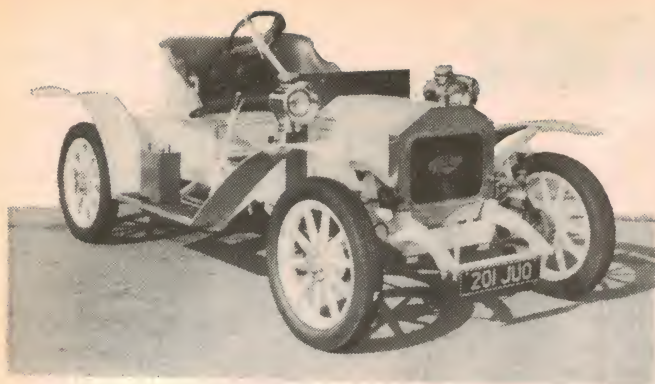
It operates on the principle that every op amp has to deliver the same current as the main amplifier, A1. A quad op amp can deliver approx 8 volts RMS to a 600Ω load, when set up in this configuration. An RC damper of 15Ω in series with a $0.047\mu\text{F}$ capacitor is sometimes useful to prevent ultrasonic oscillations.

The circuit is easily expandable to use as many as 4, 8, 20 or more op amps, for driving heavier loads. It is not necessary for the main amplifier A1 to run as a unity gain non-inverting amplifier. A1 can

function in either the inverting or non-inverting mode, and with any desired gain — bearing in mind the normal limita-



tions regarding bandwidth and distortion.
(From National Semiconductor Linear Brief LB-44.)



Speed Sentry

Cheaper than a radar detector & more reliable

There is no doubt that there exists an urgent need for greater safety on our roads and that, in the main, this is the responsibility of the individual driver. We believe that our "Speed Sentry" can contribute to greater safety by assisting responsible drivers to drive within the speed limit at all times.

by GERALD COHN

The combination of a well-made road and a comfortable, quiet vehicle can easily lead to gradually increasing road speed, to the point where the prescribed limit is exceeded. By implication, this could lead to a speed which is dangerous without the driver realising it.

The rude awakening comes when we suddenly find ourselves confronted with a dangerous situation: another vehicle which appears out of nowhere; an unanticipated curve in the road for which the speed is too high, and of course the possibility of a siren or flashing blue light or a radar trap.

Another situation with which most drivers can identify is that of returning to a built up area after being on a highway for a period of time. The sudden reduc-

tion in speed limit from 100km/hr to 60km/hr makes the latter seem a veritable crawl. It is too easy to allow the speed to slowly increase under this condition, and if too much attention is being paid to the speed in an effort to keep the speed down, then not enough attention is given to the road. Also a dangerous situation.

It is to avoid situations like this that we have designed the Speed Sentry. But, as we shall see later, it has another very useful application apart from monitoring your road speed.

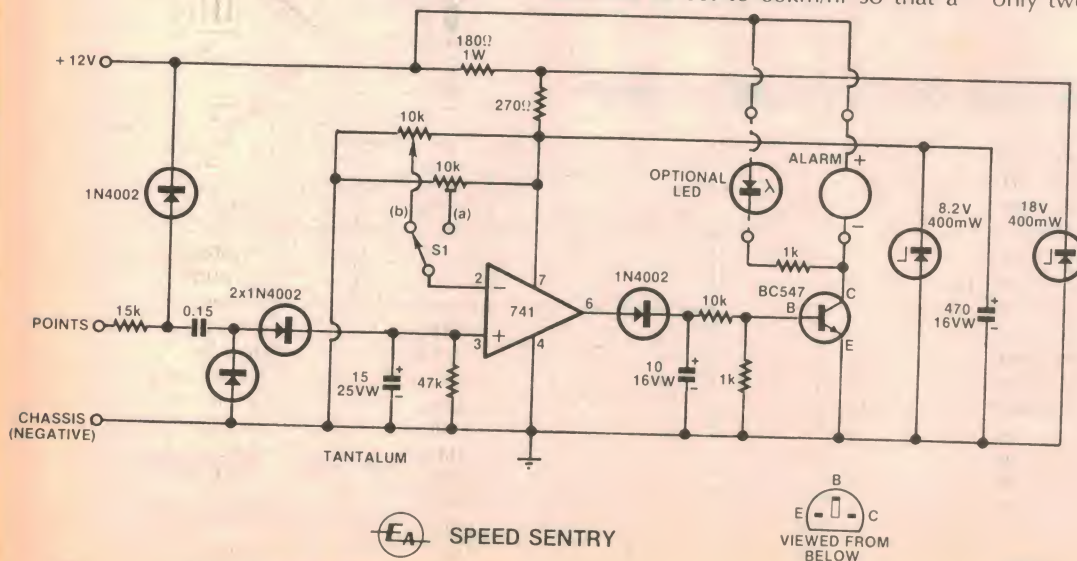
It is a simple alarm system that can be set to sound when any maximum speed the driver cares to select is reached or exceeded. It also has a preset position, which can be set to 60km/hr so that a

flick of a switch sets it up for use within the metropolitan area.

Our Speed Sentry monitors vehicle speed by measuring the frequency of pulses from the ignition system. If a particular frequency is exceeded, corresponding to a preset vehicle speed, an alarm sounds and continues to sound until the speed drops below the predetermined limit.

The main drawback when using ignition pulses to measure road speed is the fact that only in top gear is the reading a true one. At other gear ratios the alarm will sound when the engine speed reaches the equivalent of the setting for top gear. It may be possible to overcome this, with a manual transmission by mounting a microswitch on the gear shift quadrant so that the alarm circuit will be active only when top gear is selected.

Vehicles with automatic transmission also present some problems. Automatic transmission systems fall into two broad categories. Two speed types usually incorporate a wide range torque converter which, because of the coarse range of only two speeds, is used continually to



We estimate that the cost of parts for this project is approximately

\$12

This includes sales tax.

The circuit consists of a diode charge pump, an op amp comparator and a transistor output stage.

The second type of automatic transmission (usually a three speed type) incorporates a torque converter with a narrower range than the two speed type. In the top speed position it has the advantage of a mechanical locking device which couples the engine drive shaft to the tail shaft. With this type of automatic transmission, engine speed is proportional to road speed, just as in a manual transmission.

In spite of these minor disadvantages, we felt a device working from the ignition system had the overwhelming advantage of simplicity. There is, however no reason why a sensing device could not be attached to the tail shaft, or the rear axle for that matter. In this way we can constantly monitor our road speed without having to be concerned with the gear selected. There are a number of devices available that would be suitable for this type of sensor such as magnets and Hall Effect devices, reed switches or even an optical arrangement.

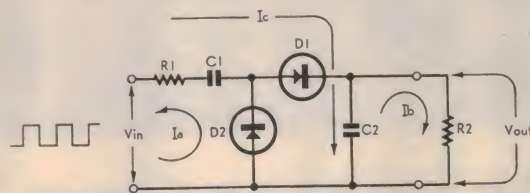
Our unit connects across the distributor contacts, ie, between the points' active terminal and chassis earth. A brief description of how the circuit functions should help readers to understand it.

The pulses from the points are fed to a diode charge pump through a limiting resistor. The output of the diode pump is a DC level that is proportional to the rate of the pulses at its input. This is applied to a comparator circuit which compares the voltage across the capacitor to a fixed reference. The output of the comparator is used to switch a transistor which has an audible alarm device in its collector circuit.

The action of the diode pump circuit may be understood by referring to Fig. 1.

At the input to the diode pump is an RC network consisting of R1 and C1. The purpose of this is to differentiate the pulses from the points. Differentiation is a process whereby the pulses are converted into spikes that are constant in area regardless of the pulses from which they are derived. It is this vital difference between the original pulse, and the spike derived from it, which makes it possible to "count" the pulses, and produce a direct voltage whose value is indicative of the pulse rate.

In order to generate the differentiated spikes, C1 and R1 must be of such value that C1 charges very rapidly on the application of a pulse. It is the brief pulse of current which flows during this charging function that constitutes the spike. Since C1, once charged, cannot pass any more current, then the length of the rectangular input pulse has no effect.

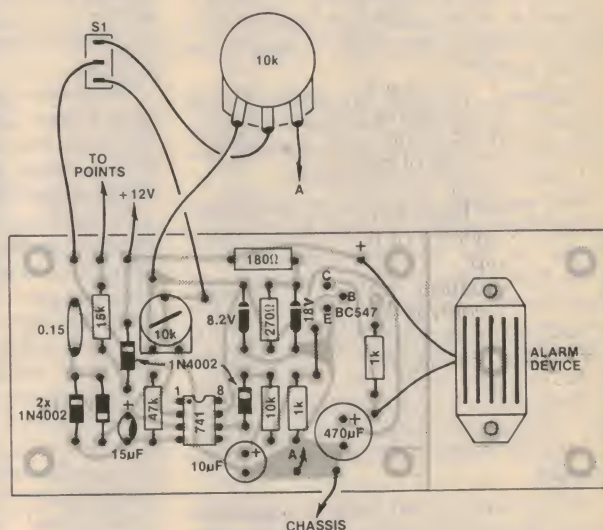


BASIC CIRCUIT OF A DIODE PUMP

Figure 1

ABOVE: a small PCB accommodates most of the components. The buzzer can be mounted separately if desired, and its section of board cut off.

LEFT: How the "diode pump" works. It produces a DC output proportional to the input pulse rate.



RIGHT: Follow this wiring diagram when wiring up the Speed Sentry. Note that a LED indicator circuit can be used in parallel with the buzzer, or substituted for the buzzer altogether.

At the end of the input pulse, C1 must be discharged rapidly, before the next pulse appears. This can only take place through the input (or generator circuit) which ideally, should have zero impedance. Since the generator in this case is a pair of breaker points, this ideal is virtually achieved since they are shorted in the "no spark period".

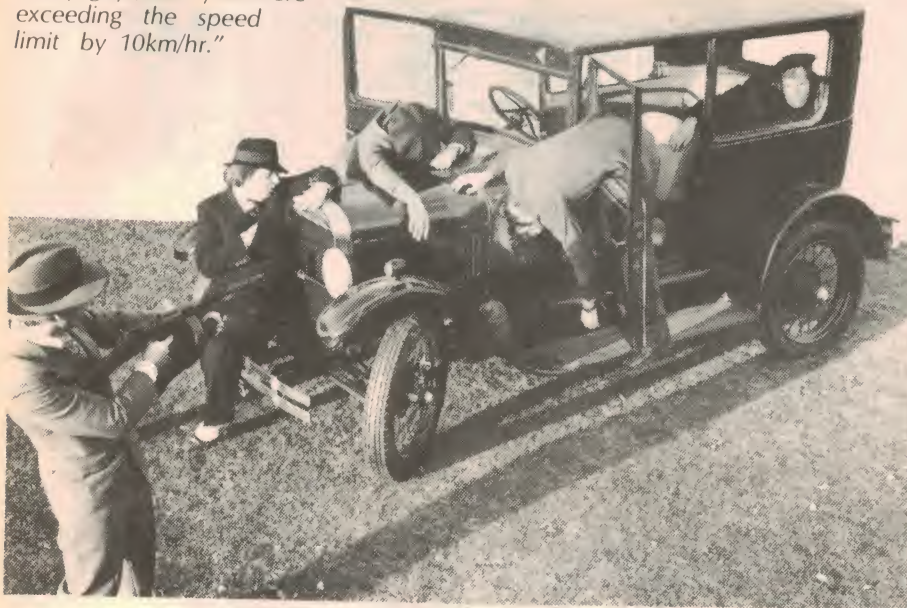
As each spike is generated, its current path (Ic) is via diode D1 and C2. As a result of this current, C2 will acquire a certain amount of charge and, thus, a certain voltage will be developed across it. With each additional spike, the

voltage across the capacitor will rise.

Capacitor C2 would in time, become fully charged, with the voltage across it equal to the spike amplitude, if some method of controlled "bleed" was not present. The load resistor, R2, performs this function (current loop lb).

Thus, when we feed a continuous train of pulses into C2, they attempt to charge it, while at the same time, R2 attempts to discharge it. The end result is a degree of charge, and a voltage that is a balance between the two. Since the discharge function is fixed by the value of R2, the actual voltage is determined by the

"Sorry guys, but you were exceeding the speed limit by 10km/hr."



variable factor; the rate at which the spikes are fed to C2. Thus the voltage across C2 becomes a direct indication of the rate of the ignition pulses.

The action of this circuit is analogous to a pump — say a water pump — which is delivering small bursts of liquid into a large container. Hence the coined name "diode pump".

Reference to the complete circuit diagram shows that the diode pump is followed by a comparator consisting of a 741 op amp and two trimpots.

Here we apply the voltage developed across the capacitor in the charge pump circuit to the non-inverting input (+) while a variable reference voltage is applied to the inverting input (-). If the voltage at the + input is lower than the voltage at the - input, the output will be close to zero volts. As soon as the voltage at the + input rises over that at the - input, the output will rapidly rise to almost 8.2V (the zener regulator voltage).

The op amp is fed from a regulated supply, derived from the 12V of the car's electrical system. Here we have used an 8.2 volt zener shunt regulator to provide us with a stabilised operating voltage. This is important for reliable operation of the circuit since any voltage changes in the main electrical system (due to the headlights being switched on for example) would result in a change in the reference levels at the inverting input of the op amp.

The output of the op amp is fed to a second diode/capacitor combination which is used to smooth any pulses appearing there. Where the voltage across the capacitor in the charge pump circuit is just at the threshold level of the com-

parator, pulses will appear at the output, due to the ripple at the input. This ripple is due to the charging and discharging of the capacitor with the input pulses.

This smoothed voltage at the output of the op amp is used to drive transistor Q1 which is a saturating switch for an oscillator-driven buzzer or a piezo alarm device.

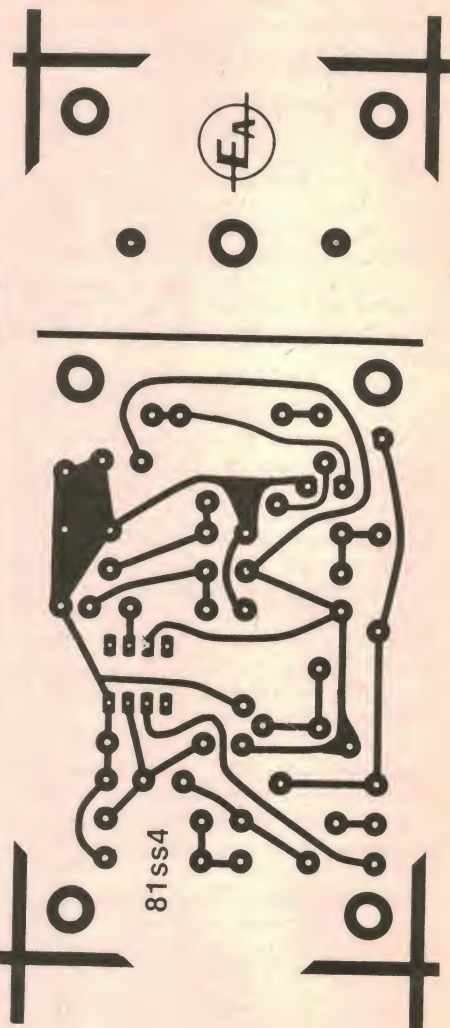
The power supply section of the circuit may appear a little strange at first due to the presence of an 18-volt zener diode. The purpose of the zener is to clip any high voltage spikes that may occur in the car's electrical system. It is not uncommon for such spikes to occur, so this was fitted to protect the op amp IC.

Further protection for the IC is provided by the diode connected to the +12V line. This limits the voltage at the input (pin 3) of the 741 to just slightly more (0.6V) than the nominal battery voltage.

The current drain of the circuit in the quiescent state is around the 5mA mark, while in the activated state (buzzer sounding) it climbs to 25mA.

The circuit would be connected to either the accessories position on the ignition switch or to another part of the wiring that is only active when the engine is running. In this way no power is consumed by the circuit when the car is not being used.

The circuit, as it is drawn, assumes a negative chassis vehicle. (If you have a vehicle with a positive chassis, then all diodes, electrolytic capacitors and the buzzer leads will have to be reversed. The op amp will have to have its supply reversed, and this means cutting the copper tracks leading to the supply pins and using short jumpers to reverse them. The transistor would also have to be replaced with its PNP equivalent.)



The actual size PCB artwork.

We have designed a printed circuit onto which all of the components with the exception of the second potentiometer and the changeover switch are mounted. The board measures 118x52mm and is coded 81ss4. Construction is simple and should not take more than an half an hour or so. The components should be mounted in the usual order; starting with resistors and capacitors, then diodes, transistors and finally the IC. There is one wire link on the board and this should be soldered in at the same time as the resistors are mounted. We have made provision on the board for an additional 1kΩ resistor which allows a series LED to be connected in place of the buzzer, or if desired, in parallel.

The external connections to the board are the power supply, the switch and the external pot. This is shown in the wiring diagram.

We have not mounted the prototype in a box since mounting requirements vary from one make of vehicle to another.

The extra pot and the changeover switch can be mounted on the dash, or, if your car has it, in the centre console. It should be noted that the second pot and the changeover switch are not mandatory to the operation of the circuit. If you wish to have only a single speed setting then the input on the board will suffice. In this case it will be necessary to place a link between the wiper of the trimpot and the trimpot to the op amp.

Once construction has been completed and the unit has been fitted to the car, you should enlist the help of a friend, either as driver or passenger, to set the trimpot.

Get the car moving at a constant speed of say 60km/hr (or any other that may be required) and then set the trimpot so that the buzzer just begins to sound. Now drop the speed back a little and make sure that the buzzer stops. Accelerating up to or just over the preset speed should cause the alarm to sound.

PARTS LIST

- 1 Printed circuit board 118x52mm (81ss4)
- 1 buzzer, oscillator driven type
- 4 1N4002 diodes
- 1 18V 400mW zener diode
- 1 8.2V 400mW zener diode
- 1 BC547 NPN transistor
- 1 741 operational amplifier
- 1 LED (optional)
- 1 single-pole double-throw miniature toggle switch

CAPACITORS

- 1 0.15uF metallized polyester (greencap)
- 1 10uF/16VW aluminium electrolytic
- 1 15uF/25VW tantalum
- 1 470uF/25VW aluminium electrolytic

RESISTORS (1/4W 5% unless specified).

- 1 x 47kΩ 1 x 10kΩ, 1 x 3.9kΩ, 2 x 1kΩ,
- 1 x 270Ω 1 x 15kΩ 1W, 1 x 180Ω 1W
- 1 10kΩ miniature trimpot
- 1 x 10kΩ linear potentiometer

The same procedure is used to set the second pot, although here the driver can do it while driving along.

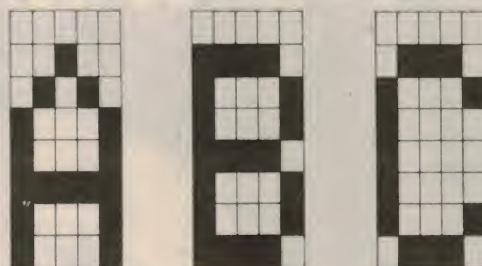
It should be noted that top gear must be engaged while these adjustments are being made.

Another use for the unit to keep track of engine revs when running in a new engine. This unit can be set up so that it is triggered when, say, 3000 rpm is exceeded. This will work quite reliably, irrespective of the gear selected. It is just another way to make sure that the new engine is run in properly.

When you have the unit up and running you may like to try out some of the other speed sensing methods mentioned earlier in the article.

Happy and safe motoring!

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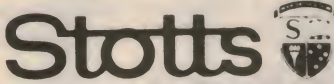
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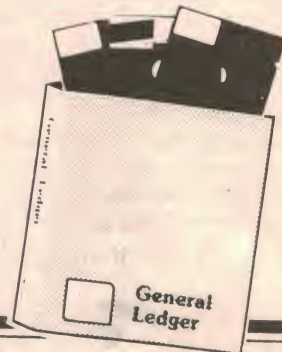
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A Tape Motor Controller for the DREAM 6800

Dumping and loading programs to a cassette recorder from the DREAM 6800 can be a real problem if the cassette motor does not start at the correct time. This circuit solves this problem and while it is not as elegant as a software-controlled system, it is easily connected to the DREAM.

by LINDSAY R. FORD*

Although the DREAM 6800 is without doubt one of the best computer designs around for the novice who's trying to get started by "rolling his own", it has one deficiency that it shares with a number of the other smaller computers on the market. This is the rudimentary system of dumping and loading programs onto tape, a system that can lead to much cursing and hair-tearing now that 4K memory expansion is available.

You can imagine the scene for yourself; it's 1.00AM and you've just finished the tedious task of programming 4K of "Chess Tournament" (or whatever) into your DREAM. You dump the program onto tape, watching with happy anticipation as the screen flickers and the data is recorded. Without further ado you turn off your DREAM for a second to destroy the memory contents, reload the program from tape and start it up. Crash!! Your reflexes, addled by hours of programming, caused you to start the dump a fraction of a second before you started the tape recorder. If this defective dump hasn't ruined the program entirely, then it will at least take very extensive editing to correct.

What you really need to overcome this problem and ensure that dumps and loads are both regular and reliable is a tape motor control. The big boys with their 64K RAM can tuck an appropriate routine away in memory, but this is a bit harder to justify when all you've got is from 1K to 4K. The only practical solution for the DREAM and similar small computers is an add-on circuit requiring no software control, and this is exactly what this design achieves. To sum up, its features are:

- (1) Tape dump control, allowing automatic tape run with about five seconds of 2400Hz leader tone before the dump commences. This removes the risk of false data being

recorded as the tape motor builds up speed and allows the start of each program to be readily identified.

- (2) Tape load control, once again with automatic tape run and with a data rejection feature that prevents the computer from commencing to load other than at the start of the data recorded.
- (3) A "dub" feature (optional), allowing comments (of the verbal type) to be recorded before each program. These help a lot if, like me, you're the forgetful type who can never remember the order the programs were put onto tape or their start and end addresses.
- (4) A paranoid degree of Schmitt-trigger input buffering to make the system immune to noise and to ensure as far as possible that bad construction, faulty components or other gremlins don't feed nasty voltage spikes back into the computer.
- (5) High impedance inputs to avoid excessive loading on the computer lines that are tapped.

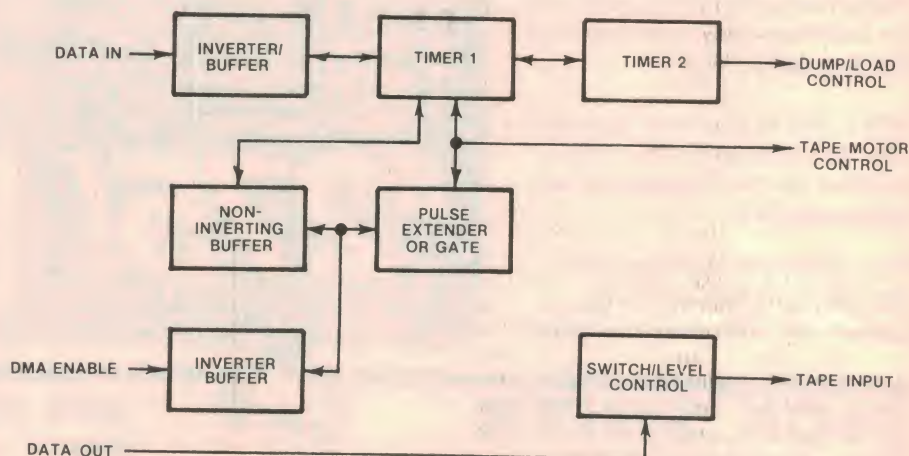
HOW IT WORKS

Many "electronics enthusiasts" seem to follow the philosophy that "understanding bars enjoyment". If you're one of them, then skip this section (and don't complain if your motor control doesn't work). Otherwise, grab a pencil and follow this explanation through the circuit diagram.

The heart of the system is the 556 timer, a cunning device that combines two timer circuits on one chip, each having a timing cycle dependant on the values of an external capacitor and resistor. In this application the timers are set to run sequentially and their outputs are buffered by transistors (as the 5-volt supply is at the low end of their operating range and thus their ability to sink a useful amount of current without significant voltage drop is limited).

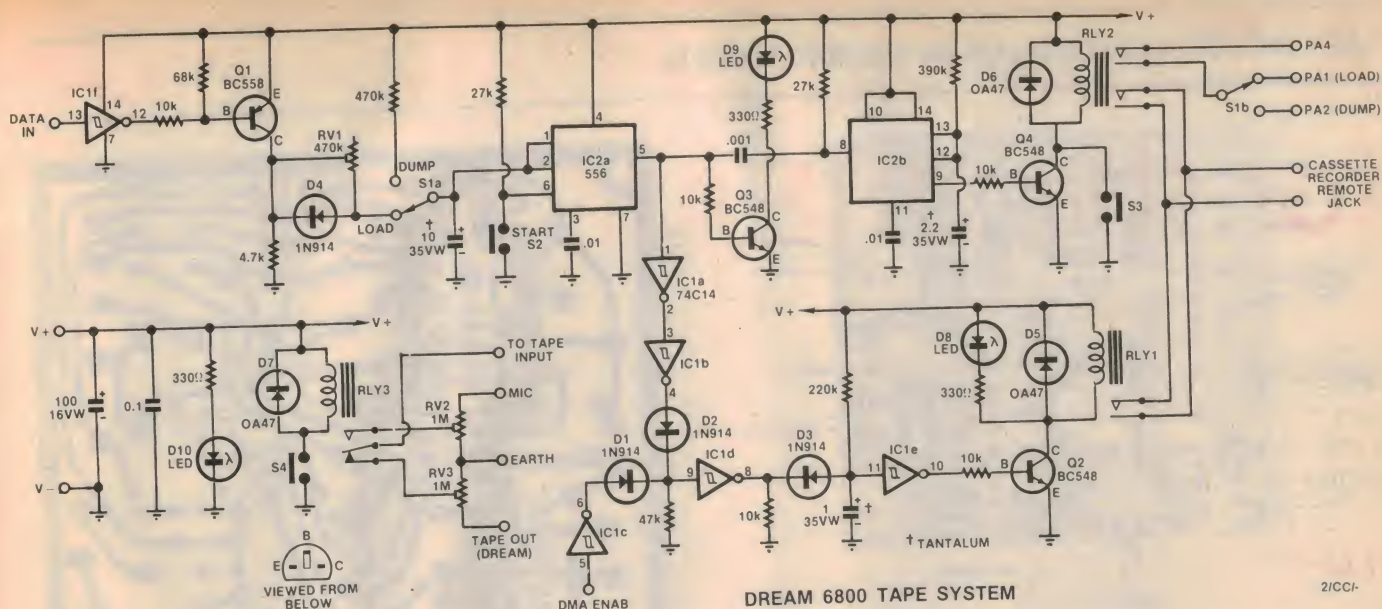
The other integrated circuit is a 74C14, a CMOS design which has six Schmitt triggers in the one package. This chip is one of the 74C family of CMOS, a group which are supposed to be pin-for-pin equivalents of the 74LS TTL family. In this application, however, the two families are not interchangeable as the TTL series lack the high input impedance of CMOS and do not switch direct to the supply rails. As both features are needed in the tape motor control circuit the CMOS type should be used and the appropriate precautions should be taken in handling it.

To analyse how these ICs function in the circuit let's imagine that a program is about to be dumped onto tape. The first step would be to set the recorder into



This block diagram will help in understanding the operation of the Tape Motor Controller.

* 6/8 Elphin Street,
IVANHOE, Victoria, 3079.



DREAM 6800 TAPE SYSTEM

2/CCI-

The third relay in this circuit, RLY3, can be regarded as optional, as explained in the text.

the PLAY mode and locate the appropriate tape position by pressing the "TAPE RUN" button (S3). This switch merely shorts the collector of Q4 to ground, closing RLY2 and allowing the tape to run.

THE DUMP CYCLE

Once the desired part of the tape has been found the recorder is put into the RECORD mode and S4 ("DUB") and S3 ("TAPE RUN") are pressed simultaneously whilst the appropriate comments are recorded to identify the program. The function of S4 is simply to switch between "Tape Out" of the DREAM and an external microphone, a relay being used to perform the actual switching as the switches used by the writer for his own DREAM were only available in a SPST type. If you wish to use a SPDT switch then the relay and D7 can be omitted and the switch contacts connected directly in place of the relay contacts. Alternately, if you're not interested in recording comments at the start of each program, then omit S4, RLY3, D7, RV2, RV3 and the external microphone.

With the desired comments recorded you are now ready to start the dump. First the traditional 0002 (FN) (0) (Start Location), (End Location + 1), (RST) (FN) should be entered to define the block to be dumped. The "MODE" selector (S1) is then set to "DUMP" and S2 ("START") is pressed.

As the contacts of S2 close, pin six of IC2 is taken low. This pin is the trigger of one of the timers on the 556 and a negative-going pulse applied to it triggers an internal flipflop, switching off a transistor which normally shorts out the external timing capacitor (C2). This capacitor now begins to charge from the positive rail via the 470kΩ resistor and will continue to do so until the voltage across it equals two-thirds of the supply voltage. At this point the internal flipflop resets and the timing cycle ends, the

time delay being approximately five seconds, but this may vary considerably due to the wide tolerances of polarised capacitors. If the delay seems unduly short or long it can be altered by changing the value of the 470kΩ resistor.

During the timing cycle the output of the timer (pin five) goes high, biasing Q3 on and causing D9 (a LED) to illuminate. This LED is of importance as it indicates that the timing cycle has not finished, a function that will be seen to be of greater significance when the LOAD operation of the circuit is considered.

The high output of IC2, pin five, during the timing cycle is also applied to the Schmitt trigger input of IC1a. This is one of a pair of Schmitts (IC1a&b) that are connected in series to buffer the timer output, taking it to the supply rail without inverting it. This buffered signal is then taken via an OR-gate formed by D1/D2 to the input of Schmitt IC1d. This Schmitt is in turn coupled with another Schmitt (IC1e) via a diode, the pair form-

ing a delay line. The operation of this line is as follows:

(a) Prior to timing cycle:

Before S2 ("START") is pressed the timer is quiescent and its output (pin five) is low. This leaves the input of IC1d to be held low by a 47kΩ resistor. As the output of IC1d will therefore be high, D3 will be biased off and the input of IC1e will be held high by the 220kΩ resistor. The output of IC1e (low) holds Q2 off, so the relay contacts remain open and the tape won't run.

(b) During timing cycle:

When the timer is started it takes the output of IC1d low and D3 begins to conduct. This takes the input of IC1e low as well and discharges the 1μF capacitor. This in turn causes the output of IC1e to go high, closing RLY1 and starting the tape. To the observer this rather convoluted sequence of events appears instantaneous, but there is in fact a brief (but significant) delay between the timer output going high and closure of RLY1.

PARTS LIST

- 1 printed circuit board, 81dt5
- 1 DPDT miniature toggle switch
- 3 momentary contact switches
- 2 5-volt relays with DPDT contacts (see text)
- 1 5-volt relay with SPST contacts (see text)

SEMICONDUCTORS

- 1 556 dual timer
- 1 74C14 CMOS Schmitt trigger
- 1 BC558 PNP transistor
- 3 BC548 NPN transistors
- 4 1N914 silicon signal diodes
- 3 OA47 gold bonded germanium diodes
- 3 light-emitting diodes, red, yellow, green

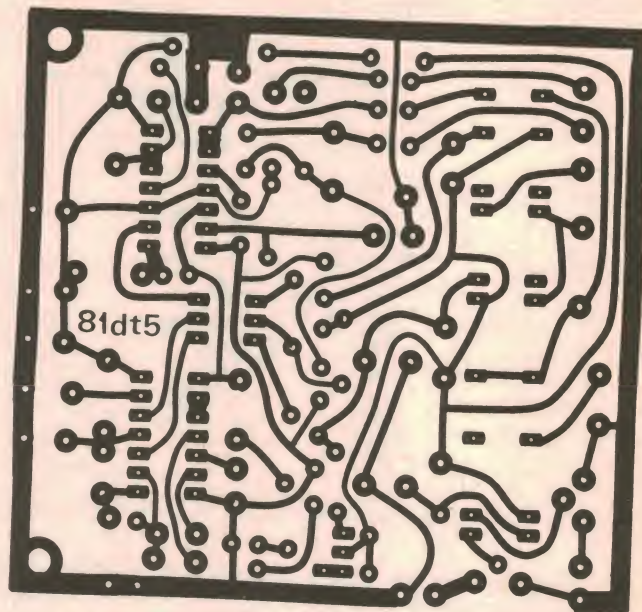
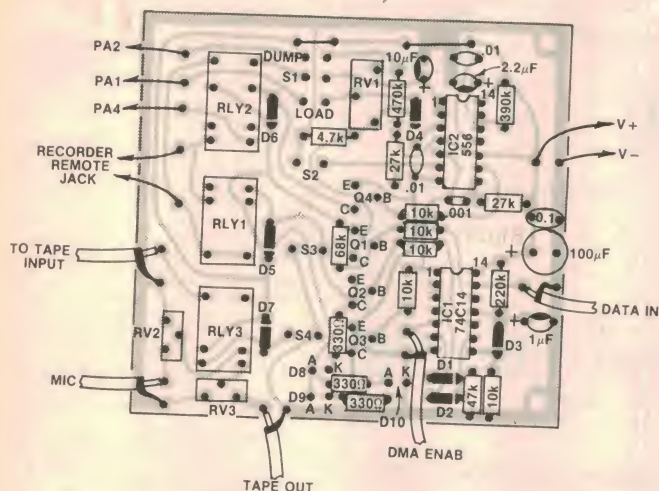
CAPACITORS

- 1 100μF/16VW PC electrolytic
- 1 10μF/35VW tantalum electrolytic
- 1 2.2μF/35VW tantalum electrolytic
- 1 1μF/35VW tantalum electrolytic
- 1 0.1μF metallised polyester (greencap)
- 2 .01μF greencap
- 1 .001μF greencap

RESISTORS

- (¼W, 5% tolerance)
- 1 × 470kΩ, 1 × 390kΩ, 1 × 220kΩ, 1 × 68kΩ, 1 × 47kΩ, 2 × 27kΩ, 5 × 10kΩ, 1 × 4.7Ω, 3 × 330Ω, 2 × 1MΩ trimpot, 1 × 470Ω trimpot.

TAPE MOTOR CONTROLLER for the DREAM 6800



Above is the component layout of the PC board while at right is the PC artwork reproduced full size.

(c) After the timing cycle:

When the timing cycle ends pin five of the timer reverts to its low state, allowing the input of IC1d to revert to its low state as well. As the output of this Schmitt goes high it biases D3 off again, isolating the input of IC1e. This input does not immediately go high, however, as the 1µF capacitor must first charge to a point where the voltage across it is above the Schmitt threshold. With the values used here, this takes about a quarter to half a second, during which time the tape continues to run even though the timing cycle is complete.

The significance of the extra quarter to half-second delay is this: when the first timer ends its timing sequence its output (IC2a, pin five) goes low, generating a negative going pulse which triggers the second timer. This timer runs for about half a second closing RLY2 and starting the dump. Unfortunately a short but finite time elapses between the first timer ending its cycle and RLY2 closing. If the delay line formed by IC1d&e were

not included in the RLY1 circuit, then RLY1 would open momentarily before RLY2 closed, leaving the tape motor without power for a brief instant. This would cause the tape to slow just as the dump commenced, distorting the first few bytes recorded.

The delay line IC1d/e overcomes this by holding RLY1 closed for a sufficient time for the dump to begin, at which time the "DMA-Enable" line in the DREAM goes low to turn off the video section of the computer. As this line goes low it also takes the Schmitt output of IC1c high, once again biasing the delay line on and keeping the tape running throughout the duration of the dump. This means that the tape runs continuously from the time the "START" button (S2) is pressed until about quarter to half a second after the dump is complete (as the delay line continues to hold RLY1 closed for a short time after the dump ends and "DMA-Enable" goes high). Visual indication of tape run is given by LED D8.

THE LOAD CYCLE

Having dumped your program onto tape, the next trick is to get it back again. As before the relevant programming steps must be gone through to define the load, but this time the "MODE" switch (S1) is set to the LOAD position. This change means that the timing cycle of the first timer is now controlled by RV1 which is adjusted to give about four seconds delay. It also means that closure of RLY2 will trigger a load rather than a dump.

If these were the only differences, however, there would be little point in incorporating a load cycle in the circuit. All that would be necessary would be for the load to be initiated in the usual way when the leader tone at the start of the program was heard. The problem with this manual system of loading is that it assumes that the programmer is fairly adept at triggering the load during the leader tone (not too difficult) and that electrical noise in the data line does not cause the load to commence during the leader tone itself (where did all those FFs come from?).

To remove this hassle, a data rejection feature is included which allows the "START" button to be pressed even though the tape is not actually on the leader tone. It doesn't matter if the tape is in the middle of the program before the one you want to load, the load still won't commence until it is required to.

This function is performed by the Schmitt trigger on the "data in" line (IC1f). If no data is present on the tape then the "data in" line will be low and the outputs of IC1f and Q1 will be correspondingly low. This in turn allows D4 to conduct and the timing capacitor for IC2a is prevented from charging. It is only when the 2400Hz leader tone comes

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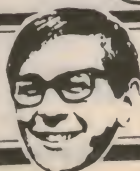


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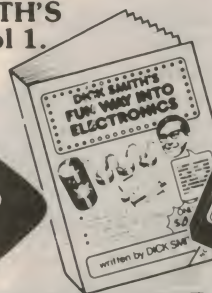
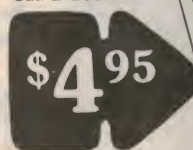
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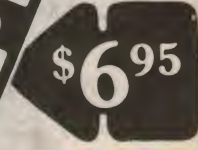
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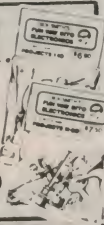
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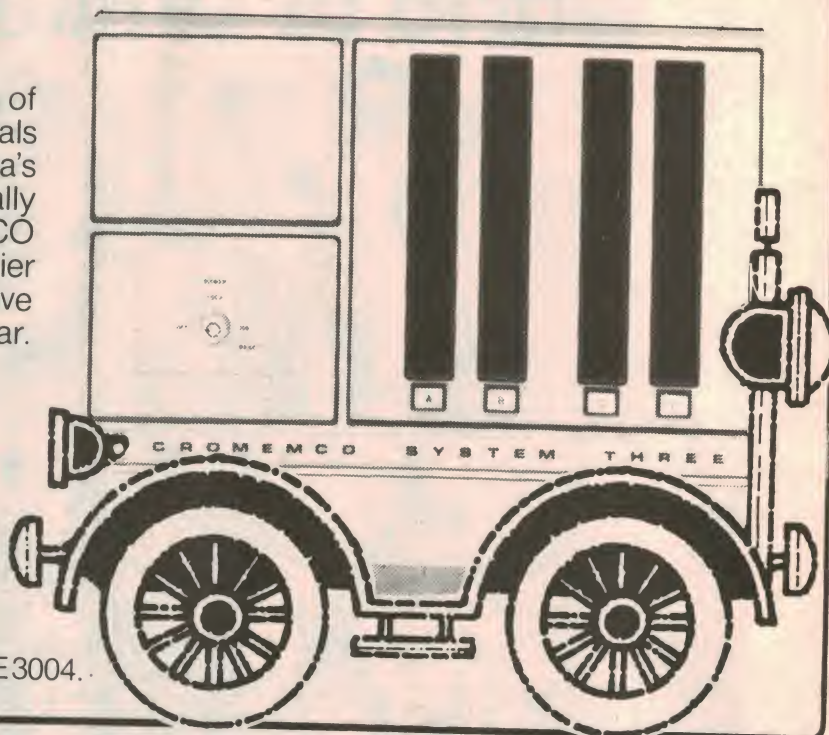
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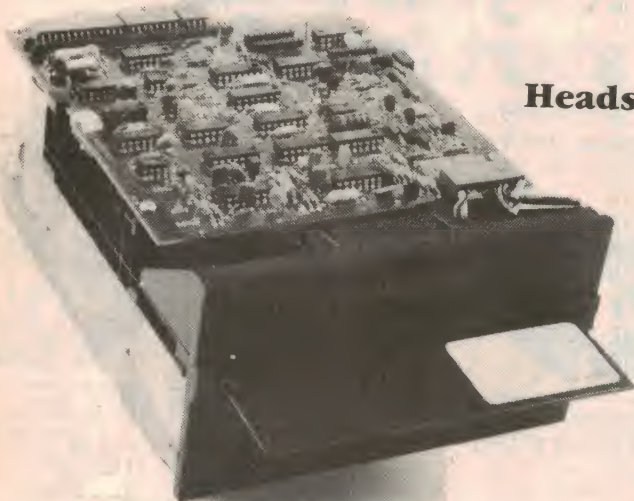
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TAPE MOTOR CONTROLLER

on the tape that the data line goes high for long enough to hold D4 off for a sufficient time to allow the timer to complete its cycle. At this stage the load begins and the circuit operates exactly as it did for the dump cycle.

CONSTRUCTION

Although the theory of operation of the circuit is a little complex, its construction is quite straightforward. First install the two jumper leads, followed by the diodes, resistors and other low profile parts. Leave the larger parts such as the relays until last.

As in any circuit, care must be taken to ensure that the orientation of all polarised components is correct and the usual precautions should be taken with the CMOS chip (keep your fingers off its pins!) All things considered, it is probably better to spend a few extra cents on IC sockets for the 74C14 and 556, rather than having to spend hours wondering why some part of the circuit doesn't work.

One thing that should be carefully checked before the circuit is put together is the pin connections of the relays. The type I used were an unbranded model with a black plastic body and a clear top. They were available from three suppliers I checked (Magraths, Davred Electronics and Dick Smith), but Dick Smith also had some in which the plastic case was clear all over and the pin connections were different.

Also on the topic of relays, don't let any supplier talk you into using 1N914s instead of the OA47 gold-bonded diodes specified for D5-7. These diodes suppress voltage spikes as the magnetic field in the relay coils collapses, and 1N914s just aren't fast enough to do the job reliably in this application.

GETTING IT GOING

A real recipe for disaster with a circuit of this type is to just wire it up and hit the power. There is a possibility that such haste will be greeted by clouds of smoke and (heaven forbid!) these could well be coming from your DREAM.

The proper way to test the circuit is to approach it a step at a time, beginning with only V+ and V- connected and with IC1 still safely in its conducting foam. When the power is switched on D10 (a LED) should illuminate, but nothing else should happen (apart, perhaps, for a click from one of the relays). Now try setting the "MODE" switch to DUMP and pressing the "START" button. D9 should light and remain on for about five seconds, after which RLY2 should briefly close and D9 extinguish. If this works, then try it again with the "MODE" switch set to LOAD. If D9 lights and stays lit and nothing else happens, then your 556 timer is working correctly (switch the "MODE" switch

back to DUMP and D9 will extinguish after about five seconds).

Now try pressing the "TAPE RUN" and "DUB" buttons — if this is greeted by closure of their associated relays, then these are working too. The next step is to insert IC1 and connect the "DMA-Enable" input (on the PCB, not on your DREAM) to V+, using a jumper lead fitted with alligator clips. Switch on the power (RLY1 may close briefly as the 1μF capacitor charges), set the "MODE" switch to DUMP and press the "START" button. This time RLY1 should close and D8 and D9 should illuminate as soon as the "START" button is pressed. The LEDs should remain lit for about five seconds, after which D9 should extinguish, RLY2 should close briefly, then RLY1 should open and D8 extinguish. If things don't happen in this order (particularly if D8, D9 and RLY1 switch off together), then the most likely answer is a fault in the buffers or delay line. Check that D2 and D3 are correctly oriented and that they work (remove IC1 before testing with your multimeter). If these are OK, then either Q2 is faulty or you've been fiddling with the pins on IC1 and it has died.

If you get the correct sequence of operation for the DUMP cycle (and you should if you've been careful putting the circuit together), then try taking the jumper lead on the "DMA-Enable" input from V+ to V- (with the power on). This should close RLY1 and light D8. Taking the lead back to V+ should switch them both off again, but only after a brief delay. If any of this doesn't happen, then either D1 is reversed or faulty or IC1 is defective.

Having got this far, it should now be safe to wire the circuit into your DREAM. Use shielded cable throughout to minimise noise, connecting the shields to the earth points provided on the PCB. Now try dumping a program onto tape using the steps outlined in the section on "How it Works" (and making sure that you've kept a spare copy of the program in case you lose it). The dump should go off without any problem if all connections to the DREAM are correct, although RV3 might need a little adjustment to get the level correct. If you find that some of the data early in the dump is corrupted, then power is being removed from the tape motor briefly as the dump begins (ie, the delay line isn't working) or electrical noise from the relays is causing the dump to go astray. In the latter case you should check that the shields to all cables are earthed and that the OA47 diodes across each relay aren't faulty. If neither of these problems exist, then try putting a 0.1μF ceramic capacitor across each OA47 diode to further damp any electrical noise and, if this doesn't cure it, try reducing the value of the 390kΩ resistor to shorten the cycle of

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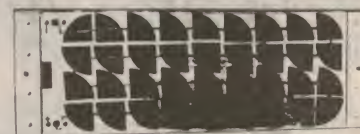
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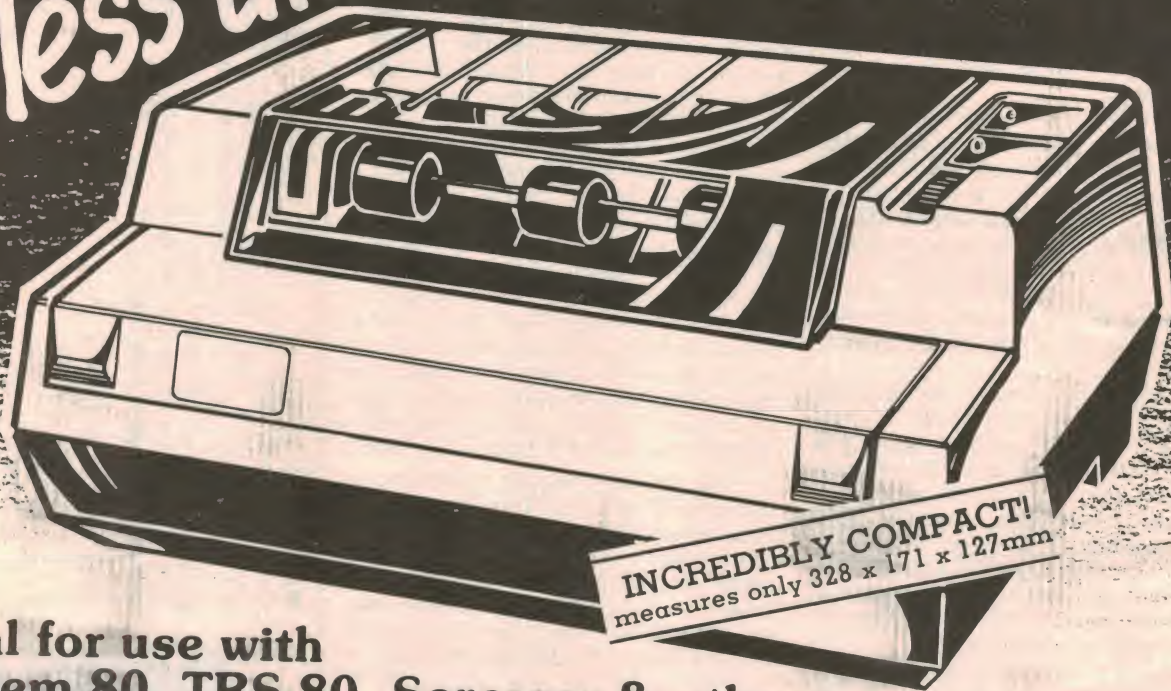
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TAPE MOTOR CONTROLLER

the second timer.

When all of this is going you can connect an external microphone and adjust RV2 to allow comments to be recorded when the "DUB" button is pressed simultaneously with the "TAPE RUN" button. Now dump a full program, complete with initial comments, and let's try loading it again.

First set RV1 to its middle position, take the tape back to the start, set the mode selector to LOAD and start the Load as detailed earlier. The moment the "START" button is pushed RLY1 should close, D8 and D9 should light and the tape should begin to run. The LEDs should stay lit through your initial comments, only extinguishing after about three to four seconds of leader tone. The load should then trigger and the tape continue to run until it ends. If you find that the load refuses to trigger then adjust RV1 a little lower. You're aiming for an optimum setting where the load triggers about one second before the leader tone ends.

If no amount of adjustment of RV1 allows the load to commence (or if it commences whether a leader tone is present or not), then you should first check D4. If this is OK, then once again a faulty Schmitt is the likely culprit. If the program loads quite happily but the first

few bytes are corrupted (and you know it was correctly dumped on tape), then the answer probably lies in your RV1 setting being a shade too high. Reduce it a fraction and try again.

CONCLUSIONS

Although the theory of operation and potential problems outlined in "Getting it Going" may appear rather ominous, there is in reality every probability that your circuit will work correctly first try. The volume of detail is only included as

the people who build this circuit may include a fair proportion of relative novices who would have difficulty tracking down a problem unless the circuit was fully detailed.

In any event, a little bit of time and effort spent on construction and setting the unit up should be rewarded by a totally reliable tape motor controller that's every bit as good (if not better) than the ones you get in the \$800 plus "Gleam Machines".

CONNECTION INSTRUCTIONS

Use shielded cable throughout and connect shields to tiepoints on the motor controller PCB.

Refer to component overlay diagram on page 83 of June 1979 issue:

"V+" - to 5V on DREAM PC board

"V" - to 0V on DREAM PC board

"Data in" - to pin 17 of IC9 or pin 8 of IC21 on DREAM PC board. This line may be accessed through the optional extended I/O socket provided on the DREAM board. Insert a 16-pin header, accessing through the pin closest to pin 17 of the PIA.

"Tape Out" - to "Tape out" of DREAM (Point 16 on DREAM circuit diagram).

"MIC" - active lead (if applicable) of external microphone chosen to suit the particular cassette recorder.

"TAPE INPUT" - Connect to microphone jack or external input socket of cassette recorder.

"REMOTE" - to "Remote" jack on cassette recorder.

"PA1, 2 & 4" - Connect to appropriate terminals on the rear of the hex keyboard.

"DMA" - to DMA Enable line of DREAM. This may be accessed by connecting the cable to the jumper lead nearest to the pin 1 side of IC18 (74LS11) on the DREAM board.

Other switch and LED connections are as per the article.

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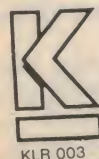
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The philosophy of computer programming:

PEOPLE SHOULD COME FIRST!

For those into computer technology, there always seems to be further places to go — new chips, new concepts, new program routines, new challenges. In that context, it is all too easy to see the machine as king and to discount the role and the feelings of the people who have to use it in their everyday work.

by J. D. MALAN

A program is a set of instructions which control the actions of a computer, and which are the link between the computer and the human world.

There are three groups of individuals concerned with any computer:

- The owner or lessee, who is concerned with the overall results;
- The operator, who is concerned with the hardware and the means of communicating with it;
- Those persons who probably never see the machine, but who receive the results, be they invoices, airline bookings, bank statements, or any of the other computer products we encounter every day of our lives.

Although not always recognised as such, there are two, and only two, philosophical approaches to computer programming, and these produce quite different results.

One of these philosophical attitudes starts with a knowledge of the hardware, and progresses outwards towards the goal of satisfying the requirements of each of the three groups of people already mentioned. In the process, each group becomes constrained in their relationship with the machine by considerations emanating mainly from the machine itself, as interpreted by the programmer. The result is a man-machine relationship in which the man is required to do most of the adapting to the dictates of the machine. It is, at best, a tolerable relationship, and at worst one of thinly veiled animosity.

The opposite approach starts from the belief that the individual is more important than the machine, and seeks, as far as it is possible within the limitations of the machine's inherent characteristics, to constrain the behaviour of the machine in terms of the reasonable requirements of each of the three groups of individuals concerned.

The result of this latter approach is a man-machine relationship in which the individual is required to make a minimum of adjustments, leading

naturally to a more harmonious, and consequently more efficient, use of the machine.

From the point of view of the programmer, the first approach is probably easier — and this could well explain why so many computer programs are of this type, even though the programmer may have been quite unaware of the philosophical basis of his actions.

But from the viewpoint of everyone other than the programmer, it is beyond question that the second of the two philosophies must produce the more desirable result. The computer is a tool, and must always be regarded as such — a very special kind of tool, no doubt, but a tool nevertheless, which must never be permitted to dominate, or even to appear to dominate, the human individuals who use it.

Selecting a Computer: Just as it would be foolish to select a Mini Minor if the objective was to obtain a vehicle to transport a family of seven, so there must be some relationship between the size of the computer hardware and the magnitude of the task to be performed. Unfortunately, there is no simple rule by which the prospective purchaser can make a reliable judgement — there is no equivalent to the simple com-

parison of the numbers of seats and passengers. Expert advice is certainly available but, once again, a question having a philosophical base is encountered.

The prospective computer user should be concerned with the philosophical approach of his advisor — a question of selection, in which technical considerations are of secondary importance.

It is, however, of somewhat greater importance to ensure that the programming effort involved, whether it be in the form of a suite of programs still to be developed or of an existing system, be founded on a philosophical approach which is compatible with that of the person in command of the project.

Programming efforts which produce less than satisfactory results can often, in retrospect, be seen to have been based on incompatible philosophical foundations.

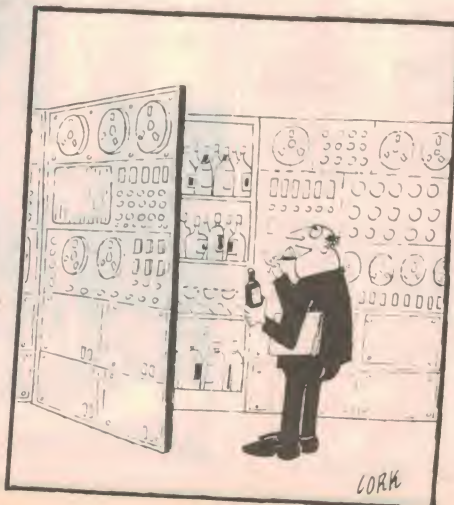
Of the three groups of individuals already mentioned, the operator is the one from whom most can be learned about the quality of the man-machine relationship. If this relationship is harmonious, and therefore more likely to be efficient, there is a much greater chance that the overall programming system will be satisfactory.

The operator, the owner and the recipient of the computer's products are all individuals primarily interested in their own affairs. If their relationship to the computer seems to them to provide them with some degree of personal satisfaction, however small, or at worst does not deprive them of some satisfaction which they value, then the machine will be regarded in a light which can best be described, to use a rather untechnical expression, as "friendly".

A harmonious relationship may be difficult to express in numerical terms, and probably will not appear as an item on a balance sheet, but there is no doubt that it will be very clearly recognised when it exists, and is unquestionably well worthwhile if it can be achieved.

Conclusion: The philosophical approach to programming can best be expressed by considering whether or not it is compatible with the fundamental nature of man as expressed in the quotation —

"Systems were made for men, and not men for systems, and the interest of man which is self-development, is above all systems, whether theological, political or economic."





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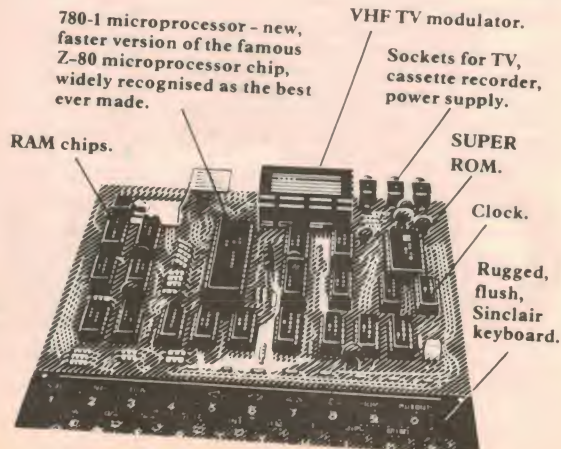
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MIVI 464

file case with a LED power indicator and four terminal posts, one for the ground connection and the others for the three rails. Heart of the unit is a low-profile transformer type PL30-9/40 from Ferguson, which is specifically intended for microcomputer power supplies. It has the advantage of providing appropriate voltage and current ratings in a single low-profile design.

Referring to the circuit diagram, we can see that the Ferguson transformer has three separate windings, viz 9V at 3A and two windings of 15V at .55 amps. The 9V winding is used for the +5V supply and it drives a PB40 bridge rectifier and capacitor filter consisting of three 2500 μ F 25VW electrolytics. This value of capacitance was chosen to ensure that the input voltage to the following three-terminal regulator never falls below the input drop-out voltage of the regulator which is 7V at 3 amp.

It would have been possible to use a single "computer grade" capacitor of 10,000 μ F rather than three 2,500 μ F as we have done but these capacitors are expensive and not as readily available.

The ripple current rating of a capacitor is the maximum RMS charging current and it comes about because any capacitor has some internal losses. The charging current therefore generates heat and this has to be effectively dissipated by the capacitor or the dielectric could be damaged.

The ripple rating of a capacitor is greater for a larger physical size, since this permits more heat to be dissipated. We have specified 25VW capacitors for their higher ripple ratings rather than their higher voltage rating.

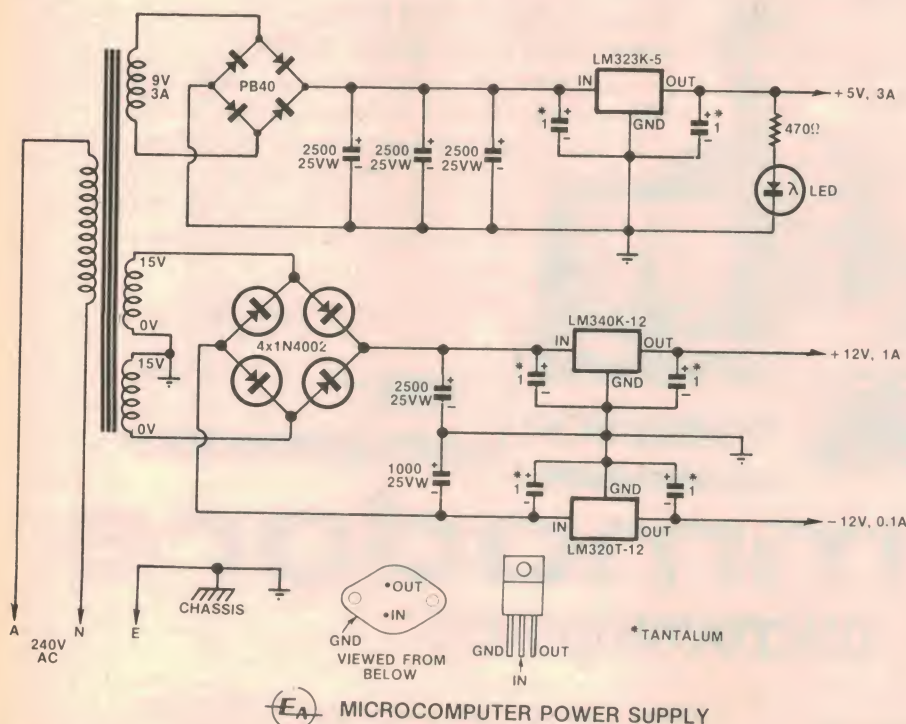
An LM323 5V 3 amp regulator following the filter generates the +5V supply. The regulator offers excellent regulation and ripple rejection and it also features overload shutdown. Since the regulator is mounted on the lid of the case, some distance from the filter capacitors, we have also included a $1\mu\text{F}$ tantalum capacitor between IN and GND terminals to prevent instability. An additional $1\mu\text{F}$ capacitor on the output provides high frequency decoupling.

We recently realised the need for a computer power supply when we began prototyping a project which required three supply rails. Rather than tie up two or three separate power supplies for the job we decided to build one compact unit that supplied all voltages required. That, at least, was the basic inspiration for this project but it should certainly prove useful for powering any prototype digital circuit or computer.

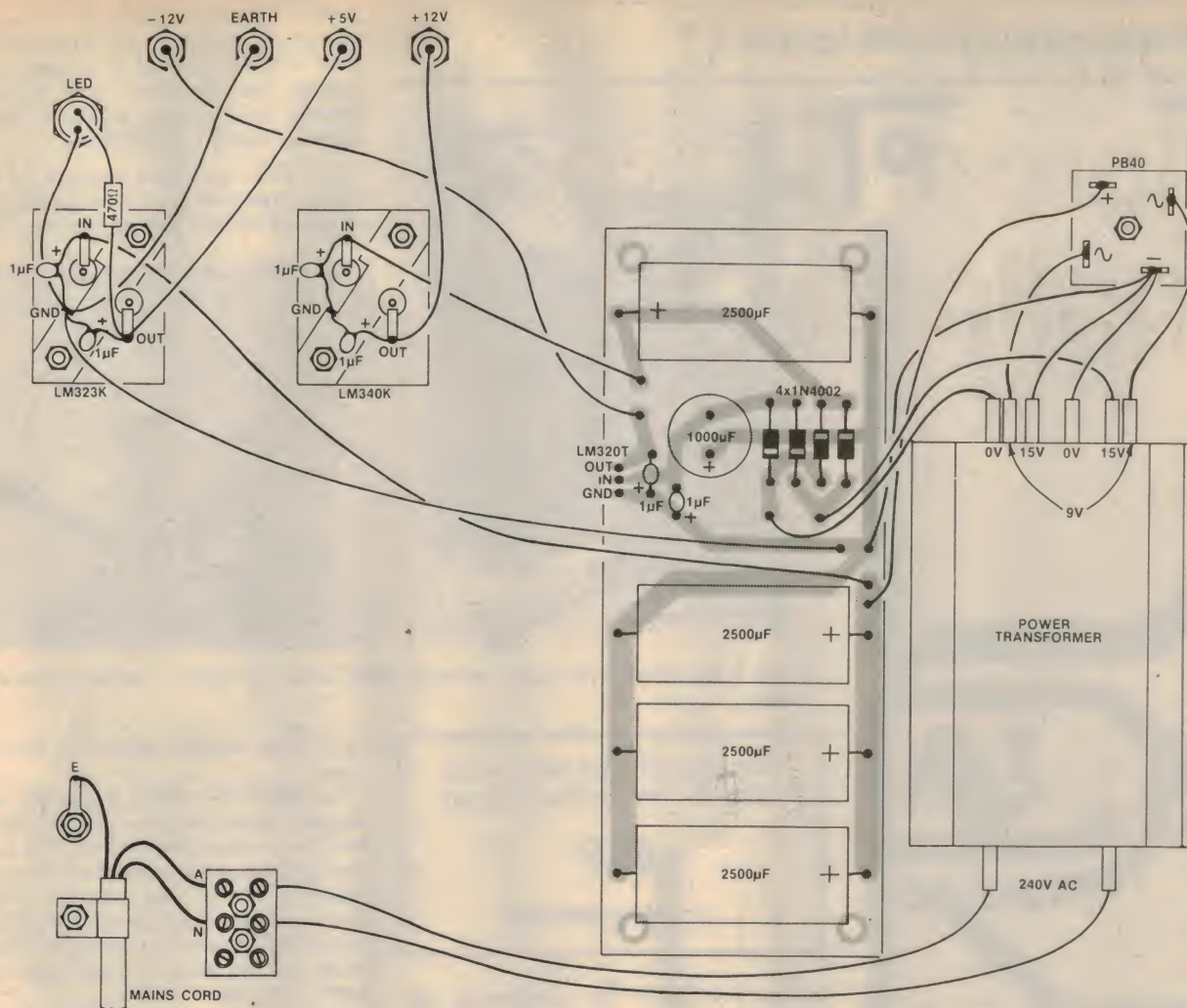
Three separate supplies are included in the unit: +5V at 3 amps, +12V at 1 amp and -12V at 100mA. The +5V supply is

the basic TTL and MOS power supply and the 3 amp rating should be sufficient for most circuits. The +12V and -12V would be suitable for powering an RS-232C interface, op amp circuitry, D-A and A-D converters etc. The +12V is also required for dynamic memory chips such as the 4116, and 2708 EPROMs. (Using an on board -5V regulator it is then a simple matter to obtain -5V from the -12V supply to power the V_{bb} supply of a 4116 or 2708).

As you can see from the photographs the power supply is housed in a low pro-



2/PS/-



The two regulators are bolted directly to the case and do not require mica insulating washers.

The two 15V windings on the transformer are connected in series and drive a bridge rectifier consisting of four 1N4002 rectifier diodes. While each winding is only rated at .55A the connection we have used permits us to take one amp from the positive supply and 100 milliamps from the negative — making the total 1.1 amps.

To understand how this is accomplished consider that we are only drawing current from the positive supply. Then diodes D1 and D3 conduct on alternate cycles, so on one half cycle D1 is conducting and the upper winding supplies current while the lower winding is off, then the situation is reversed on the next half cycle. So we can draw double the rated current because it is taken alternatively from each winding; the copper losses are the same, and so are the ampere turns so there is no core saturation.

This was assuming that only the positive supply is drawing current, but if both draw current then the total current drain should not exceed 1.1 amps. Since most current is drawn from the +12V supply, particularly by dynamic RAMs, we have nominally rated this at 1 amp, leaving the -12V supply with a 100mA

rating.

An LM340K-12 12V 1 amp regulator

PARTS LIST

- 1 folded aluminium case, 125x171x55mm (see text)
- 1 PC board, coded 81mp6, measuring 140x53mm
- 1 Ferguson transformer type, PL30-9/40
- 1 PB40 bridge rectifier
- 1 LM323K three-terminal regulator
- 1 LM340K-12 three-terminal regulator
- 1 LM320T-12 three-terminal regulator
- 4 1N4002 rectifier diodes
- 1 LED and bezel
- 4 2500µF 25VW electrolytic capacitors
- 1 1000µF 25VW PC electrolytic capacitor
- 6 1µF 25VW tantalum capacitors
- 1 470Ω ¼W resistor
- 1 mains cord and plug
- 2 TO-3 mounting sockets
- 4 4mm banana socket and winding posts
- 1 3-way mains terminal strip
- 1 mains cord grommet and clamp
- 4 9mm plastic board supports or brass spacers

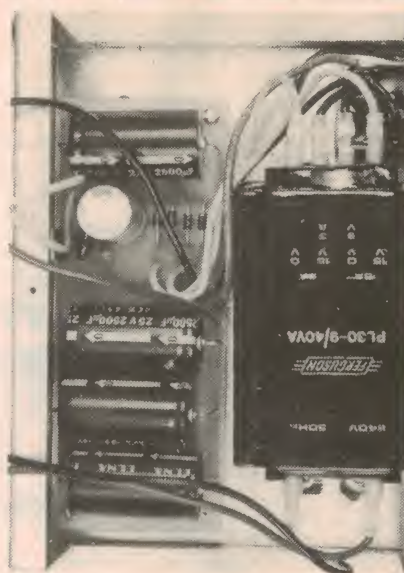
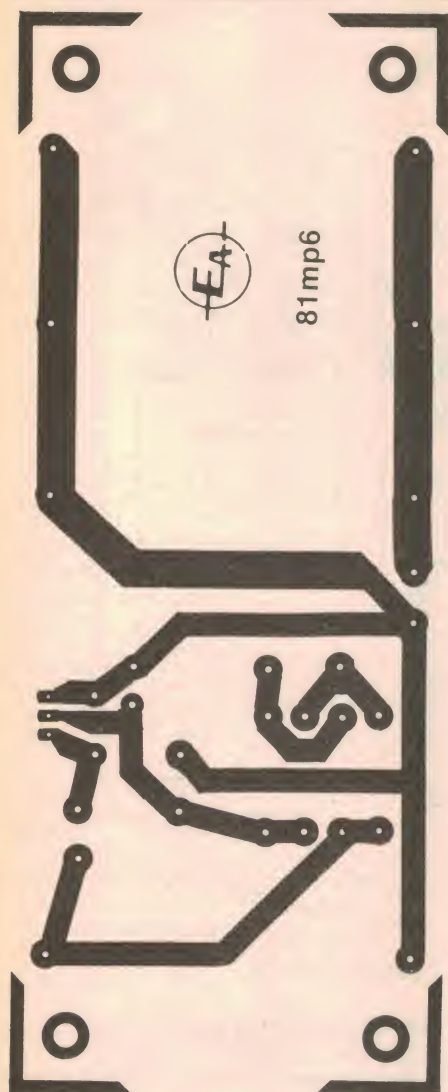
has been used in the positive 12V supply while an LM320T-12 negative 12V regulator is used in the -12V supply. For reasons mentioned earlier, ie stability and decoupling, we have included 1µF tantalum capacitors across the input and output of each regulator. These must be mounted directly on the regulator.

Construction of the unit is straightforward. All of the filter capacitors plus the -12V regulator are mounted on a PC board coded 81mp6 measuring 140x53mm. Mount the components as shown on the overlay diagram noting the orientation of the diodes and electrolytics.

We mounted our power supply in a folded aluminium case measuring 125x171x55mm. The case is available from Dick Smith Electronics and is punched for two TO-3 transistor packages so it is a simple matter to mount the 5V and 12V regulators. If desired, a diecast aluminium box of similar dimensions can also be used.

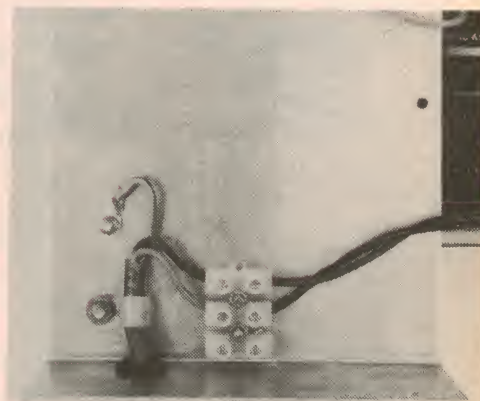
Drill holes for the mains cable entry, LED and terminal posts in the positions shown in the photographs. Note that the terminal posts are mounted leaving space on the left of the panel for the bridge rectifier which is mounted directly

MICROPROCESSOR POWER SUPPLY



plastic board supports or 9mm brass spacers. Since the case of both the +12V and +5V regulators is connected to ground the regulators can be bolted directly to the case without using insulating washers and bushes.

Use TO-3 transistor sockets to make the connection to the regulators, and spaghetti tubing to insulate the IN and



At left is the full-size PC board artwork while above are photos showing the wiring details.

We estimate that the cost of parts for this project is about

\$55

including sales tax.

behind the panel. Use appropriate colours for the four terminals to aid in identification.

Mount the PC board, transformer and PB40 bridge rectifier as shown in the internal photographs of our unit. The board can be mounted using 9mm

OUT pins on the regulators from the case.

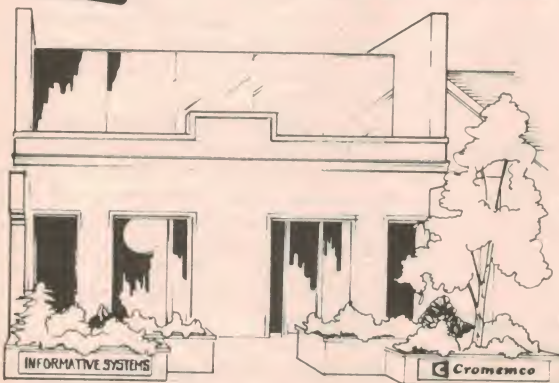
Complete the wiring using the wiring diagram provided and solder the 1 μ F tantalums capacitors on the TO-3 mounting sockets of the regulators. The -12V regulator is in the smaller TO-220 package and it is soldered directly to the board and secured to the side of the lid using an insulating washer and nylon screw and nut.

Recheck your wiring, or better still have someone else check it, because one mistake can lead to brilliant pyrotechnic displays as well as destroying the unit. (This guy has imagination... Ed.) If all is well turn the unit on and check the terminal voltages.



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Reproduced from the July 31, 1980 issue of *Electronics* magazine.

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| ROM | 1K | 1K |
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| Parallel I/O | Yes | Yes |
| Serial Printer | Yes | Yes |
| Serial Plotter | Yes | Yes |
| Serial Teletype | Yes | Yes |
| Serial Modem | Yes | Yes |
| Serial Terminal | Yes | Yes |
| Serial Keyboard | Yes | Yes |
| Serial Display | Yes | Yes |
| Serial Storage | Yes | Yes |
| Serial Backup | Yes | Yes |
| Serial Archiving | Yes | Yes |
| Serial Compression | Yes | Yes |
| Serial Encryption | Yes | Yes |
| Serial Decryption | Yes | Yes |
| Serial Authentication | Yes | Yes |
| Serial Accounting | Yes | Yes |
| Serial Auditing | Yes | Yes |
| Serial Logging | Yes | Yes |
| Serial Monitoring | Yes | Yes |
| Serial Troubleshooting | Yes | Yes |
| Serial Maintenance | Yes | Yes |
| Serial Repair | Yes | Yes |
| Serial Replacement | Yes | Yes |
| Serial Disposal | Yes | Yes |
| Serial Recycling | Yes | Yes |
| Serial Reuse | Yes | Yes |
| Serial Reproduction | Yes | Yes |
| Serial Distribution | Yes | Yes |
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| Serial Purchase | Yes | Yes |
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| Serial Leasing | Yes | Yes |
| Serial Financing | Yes | Yes |
| Serial Insurance | Yes | Yes |
| Serial Taxation | Yes | Yes |
| Serial Accounting | Yes | Yes |
| Serial Auditing | Yes | Yes |
| Serial Logging | Yes | Yes |
| Serial Monitoring | Yes | Yes |
| Serial Troubleshooting | Yes | Yes |
| Serial Maintenance | Yes | Yes |
| Serial Repair | Yes | Yes |
| Serial Replacement | Yes | Yes |
| Serial Disposal | Yes | Yes |
| Serial Recycling | Yes | Yes |
| Serial Reuse | Yes | Yes |
| Serial Reproduction | Yes | Yes |
| Serial Distribution | Yes | Yes |
| Serial Sale | Yes | Yes |
| Serial Purchase | Yes | Yes |
| Serial Rental | Yes | Yes |
| Serial Leasing | Yes | Yes |
| Serial Financing | Yes | Yes |
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| Serial Taxation | Yes | Yes |

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Cromemco logo on computer board shown in original ad



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Letters to the editor

Countdown timer for yacht racing

I noted in Information Centre of your March '81 issue an item headed "Countdown Timer". PT of Pullenvale, Qld was looking for an easy method of constructing a countdown clock for yacht racing.

For several years I have been using such a device of my own design. My "Yachtclock" has two pushbuttons: one to start at -10 minutes, one for -5 minutes. Pushing both together turns it off. The countdown is in 0.1 minute intervals until -1.0 minutes, when the format changes to intervals of one second.

After reading zero, "Yachtclock" turns itself off. I have designed a unique light tunnel which makes the two digit LED display readable in virtually any sunlit condition, and the NiCd battery is rechargeable from any 12 volt source.

Should PT or any other reader of EA be interested, I could supply a limited number of "Yachtclocks" for the cost of materials and labour (say \$80). I must point out, however, that as I do not have the facilities of a manufacturer, the product would not have the "polish" of a mass produced item.

I am presently developing "Yachtclock 2", with a LCD of minutes and seconds for the whole countdown. I cannot quote for this model yet, however.

D. Brown,
3 Juad Place,
Aranda, ACT 2614.

Success with the Mosfet Amplifier

I have just completed construction of your Mosfet Amplifier and can say without reservation that I am absolutely delighted. It far surpasses anything that I have had in the past and that includes top line models with highly respected brand names. I have since put my other (recently acquired) amp up for sale.

A friend of mine in Rabaul, who also assembled the kit, found an error on the PC board, that being the polarised 4.7 μ F capacitor in the preamp stage which is shown back to front. Also the input selector switch had to be wired differently in the kit supplied by Dick Smith. I also found that if shielded cable is used on pins 26, 27 & 28, noise level drops considerably (the circuit diagram indicates the use of unshielded wire).

This is the first kit I have ever constructed and you have now won another convert to your ranks. Congratulations on your efforts.

C. Madden,
Rabaul PNG.

COMMENT: thank you for your comments. Errata covering the wrongly polarised capacitor was published in April issue.

Sennheiser Headphone Competition

Just a short note of appreciation for conducting the Sennheiser Headphone Competition.

I have now connected up my Sennheiser 2002 Stereo headphones, and I find them to be of exceptional quality with incredible dynamic range.

Please extend my appreciation also to R. H. Cunningham Pty Ltd for providing such a valuable prize.

A. Carapet,
Belrose, NSW.

Wind generator design problems

I have recently built the wind generator described in the July 1978 issue, but used a standard alternator plus a 3:1 pulley step-up gear to achieve the correct RPM for the propeller.

It works exceptionally well, providing over 2 amps in a 20km/hr wind and over 10 amps during gusts.

However there are two "oddities" of interest. Firstly, the propeller (which has a double ball bearing axle) seems to be stalled at all windspeeds so far experienced — even with the drive belt removed — but revs at frightening speeds when given a flick start. Slow starts are of no avail. Also, once started there is plenty of torque to drive the alternator. I have assumed that it is in fact "stalled" in the rest position.

Secondly, the alternator does not seem to retain its "residual" magnetism and I have had to make a "wind" switch, which is a simple metal plate with contacts, to initiate charging at about five revs per second of the propeller by applying the B+ to the field winding.

There is also some confusion regarding the manner in which the propeller is balanced during construction. The text says: "Find the centre and drill a 1/4in hole

for testing the balance by hanging the prop on a nail in the side of the bench. It should return to the horizontal from any position..." Granted that to attempt balance with the average nail sitting in a 1/4in hole is a bit "uncouth" from an engineering point of view, it seems to me that with a proper fulcrum the propeller would settle in any random position when correctly balanced.

I would appreciate your comments on this.

Finally if anyone else has built this wind generator they may be interested to learn that a 3 Ω resistor (piece of jug element) in series with the field winding reduces the torque required for the field alone considerably thus allowing an output at lower revs — ie at low revs most (or all) of the energy goes into creating the field current which may be 2 to 3 amps at less than battery voltage — hence no charge.

At 1400rpm the 3 Ω resistor drops the output current from 5 to 4.5 amps, but the alternator is a lot easier to turn. So, in practice a higher current is possible since the RPM increases.

D. Law, VK2AIL,
Tumblong, NSW.

COMMENT: We agree that given a proper fulcrum the propeller will settle in at any position when correctly balanced. We cannot comment in detail about the propeller design, as the article was reprinted from another magazine. However if, as you state, the prop is aerodynamically stalled at rest, then it is not really suitable for use in a wind generator. Perhaps a conventional multiblade windmill design would be more suitable.

Cordless telephones

A friend loaned me a copy of EA for February '81 and I read your "Forum" article. I fully support your stand about ads for CB radios and new types of telephones.

If new types of telephones are designed and built which have significant advantages over the old types, and which can be plugged into the existing telephone system without damaging Telecom equipment, — then let's use them! We would be much better off without some of the inept, bungling, shortsighted bureaucrats we are presently stuck with. The cartoon in your article is a very fitting comment on some government departments who lazily throw new ideas into the "Too Hard" basket.

G. Costin,
Artarmon, NSW

COMMENT: At the heart of the problem is your sentence "... which can be plugged into ... without damaging Telecom equipment." Some authority with the necessary expertise has to make this judgment.

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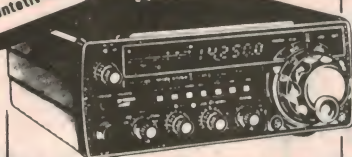


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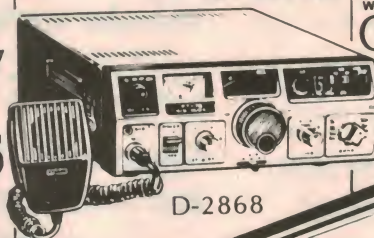


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AMATEUR RADIO

by Pierce Healy, VK2APQ



Airport "disaster" — WICEN was there

When an aircraft crashes at a major airport, the emergency services — police, ambulance, fire brigade, hospitals, airport staff etc — are expected to swing into action quickly and effectively. But how well do they really perform, both individually and as a team?

The chance to find out came on February 24, 1981. When four hours out of Sydney, on a flight from Samoa, the captain of Lunar Airways flight 9001 advised Air Traffic Control that he expected some difficulties in landing. On lift-off from Samoa the aircraft had experienced heavy vibration, followed by a thump in the vicinity of the main wheel wells.

Subsequently, Samoa tower had advised him that they had retrieved tyre debris and parts of one wheel from the runway. At the same time it was observed that the contents of No. 1 and No. 2 hydraulic systems were falling and he anticipated that he would arrive overhead with both systems inoperative. This would cause loss of nose wheel steering in addition to the damage to the main wheels.

As a result, all emergency services, both airport and civil, were put on full alert. When the aircraft arrived four hours later, at 2pm, fire engines, ambulances, and police vehicles were standing by alongside the runway, the casualty sections of three major hospitals were on standby, and a team of helicopters was waiting to ferry the injured to them.

At this time the captain advised that he was unable to extend the inboard flaps and that the landing speed would be about 20 knots above normal. The landing was attempted on the north/south runway, heading south, but the aircraft veered off the runway and broke into three sections. The tail section remained on land but the main fuselage finished up in shallow water in Botany Bay. Fifteen passengers died in the crash and 60 were seriously injured.

As the reader has probably guessed, it didn't really happen. There was no Lunar Airlines flight 9001 out of Samoa that day and, in fact, there is no such company as Lunar Airlines. It was simply an annual exercise which, by regulation, is required to be held at all major airports. It is designed to probe the weaknesses of the various emergency services, in order that

these can be avoided in the event of a real disaster.

How did WICEN become involved? By agreement with Transport Australia, the NSW State Police are in control of operations in the event of a disaster situation at Kingsford-Smith airport, and it was at



WICEN played a significant part in the recent disaster exercise at Sydney's Kingsford-Smith Airport. At the police control centre, beside the main runway, Inspector Waring (right) dictates a message to WICEN co-ordinator Don Richardson (VK2NRV/YIK) for distribution over the WICEN network.

the request of the NSW Police that WICEN participated.

More precisely they requested that WICEN set up stations at four points: the police emergency centre in the city; the disaster victim registration room in the international terminal building; the casualty section of the Prince of Wales Hospital, Randwick; and adjacent to the police control van alongside the main north/south runway.

The reason for setting up the network — apart from determining WICEN's ability to function effectively in such a situation — was to minimise congestion on the police network by providing an alternative circuit for lower priority traffic,

leaving the police network clear for urgent traffic.

Overall, the exercise went largely as planned, but with enough mistakes — a helicopter heading for the wrong landing area, ambulances which failed to meet a helicopter on time — to dispel any complacency. (It has been said that the more mistakes made in an exercise, the more successful is that exercise!)

As far as WICEN was concerned the whole operation went off better than anyone had hoped for. A completely satisfactory simplex circuit was established between all four points, in spite of some difficult locations, and the whole network was fully operational well in advance of the deadline.

Following the crash, and for the next couple of hours, WICEN handled a large amount of traffic. All messages were delivered promptly, with total accuracy and there were no technical problems. At the same time, all those handling the traffic gained valuable experience in working under pressure.

By far the most satisfying aspect, for WICEN, came at the subsequent debriefings. Police Superintendent, K. Baret, one of the referees, referred to "... the use of WICEN as a most effective innovation" and "... the reliability of licenced professional (WICEN) operators". And Police Inspector Bunt, from the emergency operations centre, referred to "... an excellent job by WICEN".

These and other more general remarks, plus a lack of any criticism, suggest that the police were more than happy with WICEN's effort. WICEN regard it as one of the most successful exercises even held in the Sydney area. They hope that when Lunar Airlines — undoubtedly the most unfortunate and inept airline in existence — tried to land a plane at Kingsford-Smith Airport next year, they will be on hand to help.

Those taking part were; Howard Freeman (VK2NL), Mike Richter (VK2BMM), David Mackay (VK2ZMZ), Keith Conolly (VK2DKC), Harry Hanigan (VK2DHH), "Blue" Easterling (VK2ABL), and Don Richardson (VK2NRV3YIK). Phil Watson (VK2ZPW) acted as photographer/observer and backup operator.

AMATEUR RADIO

From Department of Communications

The Department of Communications has advised the WIA on several matters which will improve operating conditions for the Australian amateur. Most were the outcome of discussions between the Radio Branch and the WIA.

NVBM EXPERIMENTS: Approval for Narrow Band Voice Modulation (NVBM) experiments is now in force. It applies to all full privilege and limited amateur licensees. Novice amateur licensees are not included.

NVBM is recognised as an effective method of speech bandwidth compression, but is still in an evolutionary stage. For this reason, no further minimum technical standards are to be imposed at present and system parameters based on the 1979-81 ARRL handbooks are acceptable.

Each licensee employing NBVM should identify his station (during the first 12 months of such operation) at least every 10 minutes, by normal unprocessed modulation. This requirement will be reviewed at the end of 12 months.

IDENTIFICATION INTERVAL: The Department has agreed in principal to

the interval between identifications "within transmission" being extended to ten minutes. This period does not coincide with that stated in the Regulations and it is intended that the regulations will be modified.

The Department has no objection to the identification procedure in paragraph 7.2 of the current Amateur Operators' Handbook.

"C" GROUP CALL SIGNS: The Department feels that the original need for such call signs has been largely nullified by the recent more liberal portable and mobile operating conditions.

Additionally, the Department cannot extend the "C" call concept to other than full privilege amateur licensees and also doubts whether the benefits of this system justify the departmental effort involved.

Accordingly, the "C" call series will be made available for general allocation. Existing "C" call allocations will remain so as not to disadvantage existing licensees.

WIA to WIZ SUFFIXES: The call sign suffixes from WIA to WIZ have been reserved in all states for WIA stations.

INTERNATIONAL AGREEMENT: An agreement now exists between Australia and Canada, concerning third party amateur traffic.

It is now permissible for Canadian and Australian amateur stations to exchange messages from or to third parties provided:

(a) The amateur stations are not paid any direct or indirect compensation, and

(b) Such communications are limited to conversations or messages of a technical or personal nature, for which, by reason of their unimportance, recourse to the public telecommunications service is not justified.

An approach has been made to the USA for a similar agreement.

World Telecommunications Day — ITU 116 years old

World Telecommunications Day is held on May 17 each year to celebrate the founding of the International Telecommunications Union 116 years ago — May 17, 1865. The theme this year is telecommunications and health, the World Health Organisation (WHO) joining with the ITU for the celebration.

A press release from the ITU-WHO organisation in Geneva describes a large number of situations in which telecommunications helps to improve health standards throughout the world: from monitoring the progress of smallpox and cholera patients in remote areas to aids for deafness; from Australia's Royal Flying Doctor Service and School of the Air to the rehabilitation of maimed accident victims.

A geographically broader experiment in "telemedicine" can be found in the Pacific area. Called PEACESAT (Pan Pacific Educational and Communication Experiments by Satellite), it links twelve islands and countries using NASA's ATS-1 satellite, originally launched for weather experiments.

Small ground stations costing about \$US4,000 provide two-way voice contact and facsimile for graphics such as X-rays, electrocardiograms, and charts. For the past nine years regular conferences, involving doctors engaged in many facets of medicine, have used PEACESAT to exchange information and tutorial work. Australia's participation is through a ground station in Sydney.

Telecommunications, whether it be by landline, direct radio link or via satellite did not just happen; it is the result of effort and co-operation by nations over the past 116 years.

In the forefront of such activities has been the Amateur Service, the only international communication service recognised in the ITU Radio Regulations.

Over the years, in many countries, amateur radio has been bringing help to communities hit by disasters, or obtaining assistance for individuals in remote places who needed special medical treatment. Therefore the theme this year has a significant meaning for amateurs.

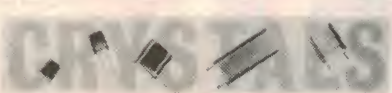
In fact, the sixth point in the Amateur's Code reads ... His knowledge and his station are always ready for the service of his country and his community ...

These notes have reported instances of outstanding assistance provided by amateurs. A more recent occasion being the disastrous Italian earthquake where amateurs played a major role in obtaining assistance.

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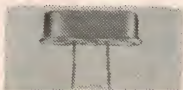
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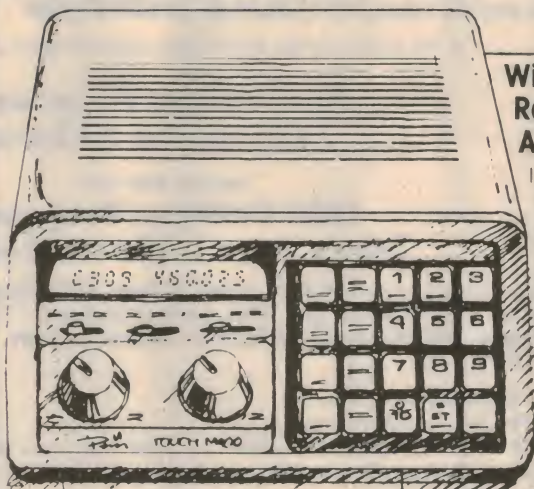
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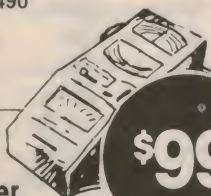
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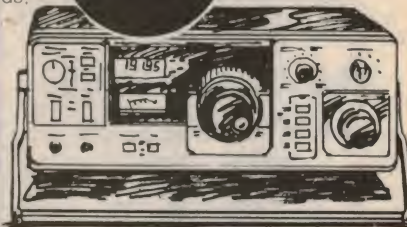
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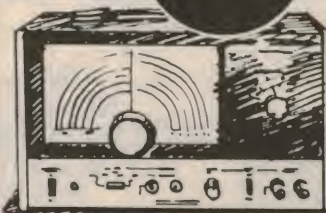
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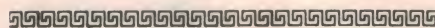
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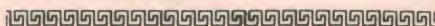
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Although no details had been received when these notes were compiled, it has been the practice to hold a worldwide amateur radio contest to mark World Communication Day. It is believed that a similar event will again be held during that weekend and interested amateurs and shortwave listeners will be able to pick up details by monitoring the DX bands.

The Townsville Pacific Festival Contest

The Townsville Pacific Festival Contest, sponsored by the Townsville Amateur Radio Club will be held on Saturday, May 30, 1981, from 0830UTC to 1330UTC.

The contest is part of the annual Townsville Pacific Festival, a notable North Queensland event. Full details from the Contest Manager TARC, PO Box 964, Townsville, Qld 4810.

WIA EMC Co-ordinator

Electromagnetic compatibility (EMC) is a problem associated with the operation of radio transmitters in close proximity to domestic electronic equipment. The problem is of concern to amateurs worldwide, mainly due to the attitude of different licensing authorities towards radio frequency interference (RFI).

The attitude ranges from a sympathetic attitude towards amateurs because of the very poor immunity of many domestic devices to RFI, to those who hold the amateur responsible for any interference.

The problem is also compounded by the attitude of some manufacturers and importers of electronic equipment.

In Norway, authorities insist that equipment with insufficient immunity be modified by the manufacturer or importer by fitting any necessary filters. Swedish manufacturers supply free on request highpass filters and/or mains filters, dealers being authorised to make minor modifications.

Dutch amateurs cannot persuade their authorities that an electronic organ is not a radio receiver. In several other European countries all cases of interference are referred to national amateur radio societies.

Because RFI problems can be wide and complex, the WIA has maintained a close liaison with Australian authorities concerning EMC.

Tony Tregale, VK3QQ, who has had extensive professional experience, has been appointed Federal EMC Co-ordinator for the WIA, responsible for providing RFI information and advice to amateurs throughout Australia.

This service is to complement the work of any existing groups concerned with RFI problems as a national service. To provide a fast and efficient service direct contact may be made. Address queries to — A. D. Tregale, VK3QQ, 38 Wattle Drive, Watsonia, Vic 3087. Telephone: (03) 434 3810.

Indian government liberalises amateur equipment imports

from Miss K. Rama, India

Indian amateurs have achieved a breakthrough in their efforts to solve their equipment problems. The manufacture of communications equipment in India is a monopoly of the public sector (Government-owned industries), which is itself so much lagging in production that it is unable to fully meet even the needs of Government users.

The Federation of Amateur Radio Societies of India had for several years made representations to the Government, requesting relaxation of import controls without much success.

The improvement in the foreign exchange position enabled the Government to make concessions to certain users — among them scientists and professionals, who were allowed to import equipment up to Rs. 10,000 for their personal use. M. V. Chauhan VU2MV, Hon. General Secretary of the Federation, saw an analogy between the scientists and amateurs. He convinced the Electronics Commission that the extension of similar privileges to amateurs was the only solution to the equipment problems.

Disaster can sometimes have a beneficial fallout. The communications link set up at Morvi by our amateurs led by Saad Ali VU2ST, President of the Federation, Jimmy Mistry VU2IJ and Vasant Bhat VU2RX, after the bursting of a dam had killed an estimated 30,000 in the span of a few hours, cleared any lurking doubts in the mind of the Government about the utility of amateur radio to the nation.

Relentless representations to the various ministries by Hon General Secretary Chauhan and President Saad Ali finally resulted in the inclusion of

radio amateurs in the category of scientists and they were allowed the privilege of importing under Open General Licence, test equipment up to Rs. 10,000 in a year. More representations, and the momentous decision was announced to permit the import of "amateur radio communication equipment including kits, accessories (including antenna rotator motors, feed lines, standing wave ratio bridge instruments), spares and components" up to Rs. 10,000 (\$US1200) in a year, without the need for a formal licence.

The Federation of Amateur Radio Societies of India is today a tower of strength to the Amateur Radio Service in India. Its QSL Bureau handles the bulk of incoming and outgoing cards. "Radio", the monthly journal of the Federation edited by M. V. Chauhan VU2MV, is read by virtually every amateur and SWL. The ARRL Handbook and other books have been imported and sold at a low price. A guide to Amateur Radio in India by Saad Ali has been published.

The Federation is not resting on its laurels. M. V. Chauhan VU2MV, Hon General Secretary of the Federation, is continuing his efforts to have the manufacture of amateur equipment thrown open to private industry, so that equipment can be made available to the less affluent for prices expressed in hundreds of rupees rather than in thousands as with imported equipment. He believes another breakthrough is on the way, which will help amateur radio in India to become the hobby of the common man and not a monopoly of the affluent.

Radio clubs and other organisations, as well as individual amateur operators, are invited to submit news and notes of their activities for inclusion in these columns. Photographs will be published when of sufficient general interest, and where space permits. All material should be sent to Pierce Healy at 69 Taylor Street, Bankstown.

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The Australian CB SCENE



We can do without the "Russian Woodpecker!"

For those who have not encountered it, the "Russian Woodpecker" is not one of the feathered species, but the name which has been given to a chirp-chirp-chirp type of interference radiated from the Russian OHR (Over the Horizon Radar) scanner. Amateur band operators have had to contend with it in the 14-28MHz spectrum, so that 27MHz CB channels are also at risk.

Over the horizon radar is not unique to Russia, of course, but the nature of the Russian signal, the power used and the directivity of the transmission is apparently responsible for the world-wide interference over a considerable slice of the spectrum.

In an effort to focus further attention on to the problem, an "Operation Woodpecker" Committee arranged a meeting recently, with the idea of co-ordinating opposition to the use of this type of OHR. The meeting is now history, of course, but the letter to hand from the Committee Chairman indicates what the problem was — and is — all about. I quote:

"Since 1976, high frequency radio communications throughout the world have been disrupted by experiments with a long range military radar system in the Soviet Union.

"The system is designed to 'see' over the horizon, and is known as Over the Horizon Radar (OHR).

"Due to the power used, estimated between 20 and 40 megawatts, a previously unknown interference is being generated and is affecting many users of the HF spectrum.

"The interference, known unaffectedly as the 'Russian Woodpecker' is a rapid pulse-type noise which makes communications extremely difficult.

"Air-to-ground, ship-to-shore and land mobile radio links are all affected. Radio operators acknowledge that the Woodpecker could blot out a Mayday call.

"The Operation Woodpecker Committee calls on you whether you be a boating enthusiast, air traveller, CB or Amateur Radio operator, or just a concerned member of the public, to add your protest.

"In the week leading up to May 1, write or phone your concern about the Woodpecker to Prime Minister Malcolm

Fraser, Foreign Affairs Minister Tony Street, Defence Minister Jim Killen, Communications Minister Ian Sinclair, Transport Minister Ralph Hunt, and your local MP.

"Last but not least, let the Russian Embassy in Canberra know how you feel about their Woodpecker: Soviet Ambassador, Dr Nikolai Soudarikov, Union of Soviet Socialist Republics, 78 Canberra Avenue, Griffith 2603.

The information was forwarded to me by Mr Jim Linton, Chairman, Operation Woodpecker Committee, PO Box 28, Boronia, Victoria. 3155.

I must add that Jim Linton is nothing if not thorough. Appended was a suggested sample letter, plus a whole string of telephone numbers of the Ministers and the Embassy involved. I have not reproduced this material, partly because of the lapse of time and the space involved. But, in any case, I feel that organised phone calls and form letters are too easily dismissed.

The most effective protest are letters, expressed in the writer's own words, from operators and listeners who have personally encountered the interference. To this point in time, they may not even have been aware of its source or its potential for disruption on a wider scale.

Coming much closer to home, I have an interesting letter to hand from Bill Lee, of Montrose, Tasmania.

Bill says that he has been a long-time

avid reader of EA and enjoys this column as a one-time 27 megger! He thought that others might be interested in a special application of UHF CB in the "Apple Isle". Best I let him tell the story in his own words:

"I sold my 27MHz gear early in '79 when the legal 18 channels became clogged, and I became a UHFer.

"Finding UHF to be a quiet and hassle-free medium, I had the thought of utilising it for a traffic, road condition, accident report service. I duly approached one of Hobart's commercial radio stations, and volunteered just that. Ken Buntain, manager of 7HT, thought that the idea was excellent and immediately organised the purchase of an FM320, power supply, Scalar "big stick" and the bit of paper to make it all legal; the licence!

"After a two-week trial period (and some reporter recruitment) Hobart's first traffic net was born officially on July 10, 1979.

"The five daily mobiles and four casuals pass morning and afternoon reports to the 7HT newsroom via Channel 22 (UHF). The information is relayed to the duty announcer who rebroadcasts it to the motorists over their car radios. One of the announcers, Stan Murrowood, christened us 'The Traffic Advisory Boys' by which we are still known as today.

"After a year of experience, I naturally thought of expansion; so why not Hobart's other Commercial Stations? In fact, Radio 7HO had just inherited a new manager, Paul Shirley, to whom I was able to put the idea. 7HO joined the net in July 1980, on channel 24.

"Today, although quite a few of the reporters have changed, the net is still performing in its community service role."

Once again, my thanks go to Bill Lee for his contribution. It is good to see CB being used in such a constructive and publicly visible way. I cannot help but feel that there must be other similar stories out there, which need only a few minutes of your time to put them into the form of a letter. My address: PO Box 406, Fortitude Valley, Queensland. 4006.

That's all for now ...

Jan Christensen

OLBIS/EA COMPETITION

Announced last month, this competition offers a PSC-301 AM/SSB rig, plus other prizes for a 250-word essay on "Why I took up CB and what it means to me now." Closing date, June 30. For details see April issue, page 100.

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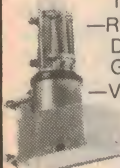
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SHORTWAVE SCENE

by Arthur Cushen, MBE



France plans four powerful relay bases

For many years, France has lagged behind the other western powers in international broadcasting but the French Government has recently announced plans to step up world-wide broadcasting from four points, with powerful relay bases being established in South America, Africa, Asia and the Pacific.

In South America, a huge relay base is to be established at Kourou, in French Guiana, using three 500kW transmitters. The station will be linked to the studios in Paris by satellite. It is estimated that there are over seven million students in Latin America learning French and the French Government realise that this, in itself, is a large potential audience. As well, the transmitting site will enable coverage of the Americas and, by reversing the antenna system, also parts of Africa. The new complex is expected to come into operation in 1984 and will certainly improve the reception of Radio France International in the American continent.

Across in Africa, France has shares in Africa Number One, the commercially operated transmitting site in Gabon, and this is already being used for broadcasts in French to Africa. Africa Number One will be remembered by readers as the station which carried out numerous tests last year and offered an automobile as a prize in a contest for reception reports. The move into Asia will result in better reception of Radio France International in that continent. Plans are also in hand to lease time on the new Deutsche Welle relay base in Sri Lanka.

What is of greater interest to readers in Australia and New Zealand is the plans of Radio France International to install a transmitting relay base in New Caledonia. This plan has been mooted for many years, but it seems it will soon be a reality, as France feels that they have a very poor reception pattern in Australia and the Pacific area in general.

A BBC Monitoring Service report states that the Director General of Radio France International, in a recent interview, admitted that France had lagged behind in external broadcasting. Telediffusion de France had some 20 shortwave transmitters which were located at

Allouis and Issoudun but this represented "a small technical potential" compared, for example, with that of the BBC "with its 80 main and relay transmitters, half located in Great Britain and the remainder throughout the world". Since the end of the Second World War, West Germany had caught up with the BBC and its broadcasting capability was "almost as important as that of the BBC". The French Government had understood for a long time that it was a handicap for the French language not to be heard.

KUWAIT MAKES CHANGES

Radio Kuwait has dropped several of its shortwave frequencies and its new schedule shows that the use of 21545kHz in the broadcast 0500-0800UTC has been cancelled; this transmission is now carried only on 15345. The broadcast includes English news at 0530UTC. The transmission for our morning reception 1800-2100UTC is now carried only on 11650kHz. This frequency provides excellent reception; the other channel which formerly carried this transmission, 15345kHz, has also been dropped from this service which is aimed primarily at coverage in Europe. This means that Radio Kuwait at present is using only one frequency for each of its English broadcasts. The channel on 9650kHz is used for reception within the Gulf area, but this does not provide effective coverage of the Pacific.

NEW BBC BASE

The BBC has announced plans for a further relay base and states that discussions are underway with the Government of Hong Kong for the establishment of a transmitter on Hong Kong Island for broadcasting to the Chinese Mainland in Chinese dialects. China at the moment is being served through a relay base in Singapore by the BBC, but it

is felt that this is not effective enough.

A site closer to the audience is desirable and negotiations with the Hong Kong Government are now underway. It is understood that the BBC and the Hong Kong Government are planning to share the costs of the new installation, which will be used by both parties during the broadcasting day.

The BBC has recently stepped up its transmissions in Russian and now has a solid block of five hours broadcasting each day from 7pm to midnight, Moscow time, in the Russian language. As well, transmissions to Afghanistan in Pushtu have been increased, in order to serve this part of Asia which has been neglected by many broadcasters from Western Europe in the past.

GOSPEL STATION

After over 30 years of silence, a Portuguese Gospel Station has come back on shortwave and has been heard on 1175kHz using a new high-powered transmitter and operating 1830-2030 UTC. Announcing as "Aqui Lisboa Emisora Radio Renascenca de Portuguesa," the station opens with chimes of a hymn and a male announcer giving full identification before 1830. Following the time signal there is a complete frequency announcement and generally an orchestral version of April in Portugal. Interference from Radio Moscow has been observed on the same frequency at 1830. The transmission includes a news bulletin in Portuguese at 1930. Radio Renascenca has recently installed high powered equipment and, in the past few years, has only operated on medium-wave and FM.

This is a Catholic Gospel Radio station and is associated with the Vatican Radio and Radio Veratis Asia. Reception reports should be sent to Radio Renascenca, Rua Capelo 5, Lisbon Portugal.

USSR REGIONAL STATIONS

As well as a 24 hour a day broadcast of the Radio Moscow World Service, English is also heard from several Regional stations in the USSR. Radio Kiev in the Ukraine carries English

SHORTWAVE SCENE

0300-0330UTC on 9665, 15100, 15185, 15240, 15255, 15295, 17870kHz. A transmission to Europe 2000-2030 is broadcast on 6020, 7260 and 9640kHz.

Radio Vilnius in Lithuania, which uses the technical facilities of Radio Moscow, is heard on 15100 with an English broadcast to North America 2300-2330 UTC. Transmissions are also carried on 15185, 15240, 15295 and 17870kHz.

Radio Tashkent in Uzbekistan has two transmissions in English 1200-1230 and 1400-1430UTC which are broadcast on 5945, 6025, 9540, 9600 and 11785kHz.

Radio Yerevan in Armenia has one English broadcast daily 0355-0400UTC which is carried by Radio Moscow transmitters on 9750, 15100, 15185, 15255, 15295 and 17870kHz.

LISTENING BRIEFS

EUROPE

SUMMER TIME: During the summer in Europe, many countries stay with their own local time and are no longer broadcasting with UTC. This means that broadcasts are heard one hour earlier. The list includes Finland, East Germany, Hungary and several other countries which will be heard one hour early up to September 27 when they will return to standard time. Broadcasts from Finland are now heard one hour earlier and the service to Australia in English is 0830-0900UTC on 21465kHz. On Sunday the "Sunday Best" program is heard 0700-0830UTC.

AFRICA

ALGERIA: Algeria has English 2100-2130 on 11740, 15307 and 21725kHz. A new frequency 25680kHz is in operation 0800-1600UTC with a broadcast in Arabic; signals are fair at the opening of the broadcast.

NIGERIA: The service provided by the transmitter on 4770kHz is currently heard with the announcement. "The English service of Radio Nigeria, Kaduna". The 4770kHz channel is in use from 0400-2400. In addition to its own programs, two news bulletins are relayed from Lagos daily at 0600 and 2100UTC.

ASIA

INDONESIA: The Voice of Indonesia at Jakarta, after spending some weeks on two new frequencies, has returned to its original outlets. The English broadcast 0800 is again received on 11790 and 15200kHz, replacing the former 11710 and 15150kHz. A later broadcast in English at 1400UTC is also on these former frequencies.

Notes from readers should be sent to Arthur Cushen, 212 Earn Street, Invercargill NZ. All times are UTC (GMT). Add eight hours for WAST, 10 hours for EAST and 12 hours for NZT.



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Books & Literature

Fibreoptics Handbook

FIBREOPTICS by John A. Kuecken. Soft Covers, 363 pages, 207mm x 128mm, illustrated with diagrams and tables. Published by Tab Books Inc, 1980. Price \$10.95.

This book is aimed at providing practical knowledge of fibre optics to the engineer and technician, and on the whole it does the job very well. After a brief historical introduction describing Alexander Graham Bell's experiments with the photophone, the author introduces the applications of fibre optics and describes their potential in many diverse fields, then goes into detail. In 21 chapters the book provides basic theory on modulation techniques, information transmission, the nature of light and wave mechanics, lenses and the varieties of optical fibres. Photodectors, light sources and practical design of optical receivers and transmitters are also well covered.

The mathematical treatment of the transmission of light and of optoelectronic devices is well handled, and is complemented by clear diagrams and illustrations of the effects involved. In keeping with the practical nature of the book the emphasis is on experiment and "hands on" experience, and circuits and constructional details are provided to allow the reader to build a low cost fibre optic transmitter and receiver unit.

Fibre optics will greatly expand the capacity of our existing communications networks, and will also make possible new applications. As well as the advantages of lower cost and higher capacity, optical fibres have properties which make them unique. One example is the fibrescope, one of the earliest uses of optical fibres, which permits internal examination of the body without surgery or the use of X-rays. Another example given is the use of optical fibres as links in equipment used for measuring the performance of high power antennas. Because the material of the fibre is not electrically conductive, it does not produce the spurious signals associated with the use of cables in this application.

A valuable feature of the book is its historical treatment of the development of theories on the nature of light. "Fibreoptics" is a nicely balanced presentation of the subject of optoelectronics,

and can also be recommended as an introduction to optical mechanics. Whether you're looking for detailed theory, circuits for immediate use or an overview of a growing and exciting field, this latest TAB book fills the bill.

Our copy came from Technical Book and Magazine Co Pty Ltd, 289-299 Swanston St Melbourne, Vic 3000. (P.V.)

Colour television servicing

COLOUR TELEVISION SERVICING by Gordon J. King. Second edition, second reprint. Published by Newnes-Butterworths, London. Stiff paper cover, 342 pages, 243 x 155mm, illustrated by diagrams and pictures. Price in Australia \$15.00.

The first edition of this book was published in 1971, with a second edition following in 1975 and subsequently reviewed in these columns. Stocks have been replenished with a second reprinting, but the contents remain the same.

Author Gordon King assumes that the principles and practice of monochrome television will be well known to prospective readers, or will be accessible in other books. His object, here, is to conduct readers from that position to an understanding of the NTSC and PAL colour systems. His treatment is essentially non-mathematical and his target readership includes students, and those enthusiasts, servicemen and engineers who may wish to up-date in this field.

Chapters 1 to 5 are of a general nature, detailing the background to colour TV, the science of colour, the operation of colour cameras and display tubes, and an overall view of the total system.

From there on, the Author looks at the specifics of typical receivers: Purity and convergence; Timebases, EHT and power supplies; Luminance, grey-scale, etc; Chroma circuitry; Encoding and decoding.

Chapter 11 introduces the aspect of servicing: Test Equipment; Locating faults; Service procedures; Field servicing; Alignment; Picture tube faults.

The book concludes with a chapter on modern design trends (ie up to 1975), a summary of television standards, and an index.

While the text relates to the British scene in particular, with a lingering heritage of valve type equipment, the

material would be appropriate for study in Australia. It is just a pity that Gordon King has not been able to expand the final chapter to take in the last five years.

Our copy came from Butterworths, 586 Pacific Highway, Chatswood, NSW 2067 (W.N.W.)

Radio Communication

EFFECTS OF THE TROPOSPHERE ON RADIO COMMUNICATION by Martin PM Hall. Published March 1980 by Peter Peregrinus Ltd (England) on behalf of the Institution of Electrical Engineers. Stiff covers, 206 pages 215mm x 130mm, illustrated by diagrams, graphs, tables and two colour plates. English recommended overseas price £16.50.

The author of this gained his M.Sc. degree from London University in 1963, and has since been engaged in tropospheric research at the Appleton Laboratory. Since 1970 he has been a member of the UK committee of the CCIR/ITU and a delegate to its meetings in Geneva.

The book's title may well attract the attention of typical radio amateurs, but they should be warned that it is not directed at this level. Granted, a few may find it valuable, but the majority would lack the formal training to cope with the in-depth presentation.

The book is written for communications engineers; those whose job it is to design high reliability commercial or military radio circuits over a wide variety of paths and, for the most part, using frequencies above 30MHz.

Since the propagation medium — the troposphere — is the major variable in any such system the author has attempted to set down and quantify all the factors which contribute to this variable, taking into account the frequency band to be employed, the standard of service required, the economic factors involved, and so on.

The book is divided into eight chapters, the titles of which give some idea of the overall contents. (1) Introduction. (2) Atmospheric Refractive Index. (3) Precipitation, Cloud and Atmospheric Gases. (4) Terrestrial Line-of-Sight Paths. (5) Earth-to-Space Paths. (6) Transhorizon Paths. (7) Area Coverage. (8) Radio Interference.

There is also a very extensive bibliography at the end of the book, occupying no less than 17 pages of small type. This alone should prove extremely valuable to any communications engineer.

In summary; a specialised textbook for the advanced engineer, containing a wealth of formulae, charts, graphs, and references probably unavailable anywhere else in a single volume.

Our copy came direct from the publisher. (P.G.W.)

1981 World Radio & Television Handbook

1981 WORLD RADIO & TELEVISION HANDBOOK, edited by Jens M. Frost. 35th edition. Soft cover, 600 pages 230mm x 145mm.

This year, the Handbook was printed for the first time in the United States, having previously been produced in Britain. In consequence, it has been completely reset and, being printed on heavier paper, weighs more than the earlier editions.

In terms of content also, it is the biggest yet, as the information expands to keep pace with World broadcasting.

The Handbook follows the same format as in the past. It gives information about every radio station under country and continental listing and, at the back, has a cross reference by frequency of all medium and shortwave stations of the world. The new Handbook also includes "Listen to the World", a 62 page section which highlights items of interest to the radio listener.

The excellent series of reviews of present-day receivers is continued. Furthermore, as this is the year of IYDP (the International Year of the Disabled Person) there are appropriate articles, including one by Arthur Cushen who looks at listening for the blind.

Traditionally, The World Radio & Television Handbook has been used widely as a reference guide by broadcasters throughout the world and is found in most of the leading libraries in each country. The book is available from the Technical Book and Magazine Co 295-299 Swanston St Melbourne 3000 or from other technical bookstores.

A brochure on the 1981 edition is available from Arthur Cushen, 212 Earn Street, Invercargill, New Zealand. (A.T.C.)

Technical education forum

FUTURE DIRECTIONS IN SKILLS TRAINING. Sponsored by the NSW Council of Technical and Further Education.

Held in August last, at the College of Catering Studies and Hotel Administration, Ryde, NSW, the Seminar was concerned with technical training in the broad sense — not just in relation to a single industry. It provided a forum for discussion between 170 representatives of employers, trade unions, Federal and State Government departments, education and training authorities.

The need for skilled workers was not questioned but there was much discussion of the options available which might offer a solution to the problem. Stiff paper covers, 102pp 297mm x 209mm.

Copies of the report are available on written request from The Secretary, Department of Technical and Further Education, GPO Box 2626, Sydney 2001.

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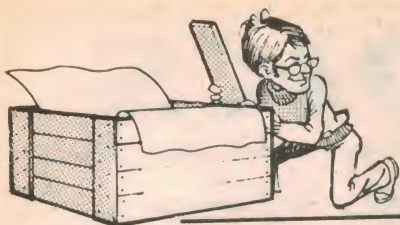
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New Products

Low-cost telephone answering machine

Featuring microprocessor control, this low-cost telephone answering machine from Dick Smith Electronics is both easy to install and operate. It boasts a range of functions including automatic tone recording, no message and last message received signals, and optional remote control from any standard telephone.

The most complicated thing about this telephone answering machine is its name — the "XK-2100 Computer Controlled Message Centre with Remote Control". Despite the "high-faluting" title, this unit is the first truly affordable Telecom-approved telephone answering on the market, at least as far as most readers will be concerned.

As supplied, the unit comes well-packed in polystyrene foam and a cardboard box. A pre-recorded C60 cassette, dynamic microphone, plugpack power

The fitting instructions supplied point out that Telecom Australia is the only organisation legally permitted to connect the unit to the public telephone system. Consequently, two application forms suitable for lodgement with Telecom Australia are included. Where Telecom regulations do not apply, for example on a private telephone system, the user can personally wire the unit to the telephone socket. The fitting instructions are easy to follow and a diagram shows the necessary wiring details.



supply, user manual and fitting instructions are all supplied as standard. The optional remote beeper is available as a separate item.

The machine is made from grey impact-resistant plastic with overall case dimensions of 150 × 60 × 225mm (W × H × D). Mass is 1.6kg. The plugpack is a large 50 × 90 × 60mm (W × H × D) and can supply a hefty 15VDC at 600mA, while the portable remote beeper is a pocket-sized 40 × 109 × 22mm.

Arranged on the front panel are three pushbutton switches for "message report", "absent" and "skip" modes, an on/off volume control, and a system override switch. All but the override switch have indicating LEDs which operate in flashing and/or continuously illuminated modes.

Once the answering unit has been connected to the telephone line, it is ready to be tested. The plugpack supply is connected to a convenient mains outlet and the sample pre-recorded cassette is installed. By pressing the "Absent Mode" key the unit will automatically rewind to the beginning of the tape, ready to accept telephone messages.

Upon dialling, and after about five rings, the telephone answerer responds with: "Thank you for calling. We are sorry we cannot take your call personally. Your call is important to us. Please leave your name and telephone number after the 'beep' and we will get back to you as soon as possible. Thank you and here is the beep". After the "beep" you can leave your message and this is recorded on the cassette. The machine

automatically hangs up after a set time of 30 seconds, when a pre-recorded tone is detected.

The 30-second message interval is fixed and, for this reason, the machine will not immediately answer another call when the original caller hangs up. Instead, it will keep the line ringing until the tape has stopped at the next segment containing the pre-recorded announcement.

The recorded messages can be retrieved in either of two ways. First, by pressing the "message report" key, all messages are played back minus the prerecorded announcements (thankfully). The unit can then be left to record messages continuing from the last recorded, or the messages can be erased by further incoming calls if the "absent" key is pressed.

The second method of playback is via the optional remote beeper. The telephone answerer is called from another telephone. When the pre-recorded announcement asks you to leave a message, an audible "call-in" signal from the beeper is sent down the telephone line instead. The answerer will respond with a return tone indicating either that no messages were received or that messages will now be played back.

Once all the messages have been played back, a last message tone is given. The caller then has the option of recording new messages after the last recorded message by pressing the "keep messages" button on the beeper. Alternatively, he can record new messages over those just played by simply hanging up (the tape automatically rewinds to the beginning of the spool).

From the previous discussion it can be seen that the inbuilt dedicated microprocessor does a good job of keeping the owner well informed about the state of the answerer. As well as those features already mentioned, a flashing LED over the "absent" key indicates that at least one message has been received, while a flashing LED over the "absent" and "message report" keys indicates that the cassette is full to capacity with messages.

In addition, a flashing LED over the "skip" mode key indicates operational problems.

The "skip" key itself enables the user "skip" to the beginning of the next message during playback. This

eliminates the need to listen to unused portions of the 30 second message period, or to callers who did not leave a message, resulting in a recording of the dial tone.

Although the pre-recorded test tape is useful for setting the answering machine up and for testing, the pre-recorded announcement may not be suitable for many applications. One disadvantage is that it does not mention the company name at the beginning of the call. For this reason, many users will prefer to record their own announcements.

The tones necessary at the beginning of the tape, at the end of the pre-recorded announcement and at the end of the message interval are all recorded automatically. In addition, prompting in the form of flashing or continuously illuminated LEDs is provided. As with the message interval, the announcement interval is fixed, in this case at 16 seconds.

It was during the recording procedure that a minor problem with an otherwise well-designed machine arose. The problem has to do with the delay time before recording of the first start of announcement tone occurs. This appears to be too short for cassettes which have a plastic leader at the start and finish of the magnetic tape. In the case of the test tape, we found it necessary to remove the tape leader before the machine would accept that any recording had been made. The problem can, of course, be solved by using leaderless tape.

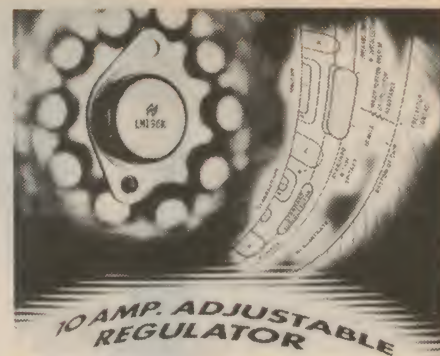
Another drawback of the answering machine is that separate pre-recorded announcements are necessary for each message to be received. For example, some 25 announcements are recommended for a C60 cassette tape (12 for C30, 40 for C90) and recording these can become tedious. However, once the recordings have been made they will not be erased by the machine and can be reused indefinitely (the erase function is inhibited for 16 seconds every time the pre-recorded message start pulse is detected).

Naturally, this machine costs considerably less than those using endless tape for the recording announcement, and which require only one recording of

Three terminal 10A voltage regulator

National Semiconductor Corporation has introduced a monolithic three terminal adjustable voltage regulator which can supply currents of up to 10 amps. The LM196 offers a claimed performance equal to or better than existing lower power IC regulators, and will operate with a 200°C maximum junction temperature in the output power transistor.

This high temperature specification allows the regulator to dissipate 45 watts at a case temperature of 125°C. Up to 70W can be dissipated at lower temperatures. All of the protection features such as current limiting and automatic thermal shutdown found on



National's other adjustable voltage regulators are also available on the LM196.

For more information, contact National Semiconductor (Australia) Pty Ltd, Cnr Stud Road and Mountain Highway, Bayswater, Victoria, 3153.

Compact optical switch for position sensing

Total Electronics Pty Ltd has available a new series of high resolution optical switches. The OPB820 series each contain a gallium arsenide infrared emitting diode and a silicon phototransistor in a black plastic slotted housing measuring 6.1mm wide by 7mm high and 15mm long.

The OPB820 series is intended to be used for high resolution position sensing in conjunction with a slotted rod for linear position sensing or a slotted disc for rotary position sensing. Applications include sensing of machine tool worktable

location, typewriter carriage location and print head location.

Also available from Total is a new series of power MOSFET devices from Motorola, which allow simplified design of driving circuits and fast switching times.

The Motorola power MOSFET products available are enhancement mode, N-channel silicon gate devices. The six products initially available include TO-3 and TO-220 packaged devices offering ratings of 450-500V at 4 amps, 350-400V 5A, and 60V and 100V at 12A.

For more information contact Total Electronics, GPO Box 1286K, Melbourne, Victoria, 3001.

the announcement to be made.

One further feature that deserves a mention is the override (or hold) switch. This enables the user to break into an incoming call (monitored by simply turning up the volume control) and speak to the caller personally. In addition, the override switch enables the telephone to which the machine is connected to be used in the normal way.

Overall, the telephone answering system represents good value for money, especially when the many ex-

cellent features are considered. In particular we liked the features afforded by the microprocessor, the remote control beeper and the well written user manual.

Cost of the telephone answering machine is \$199, while the optional bleeper sells for \$39. These prices include sales tax. The machine is Telecom approved and is available from all branches of Dick Smith Electronics stores and from Dick Smith resellers throughout the country. (JC).

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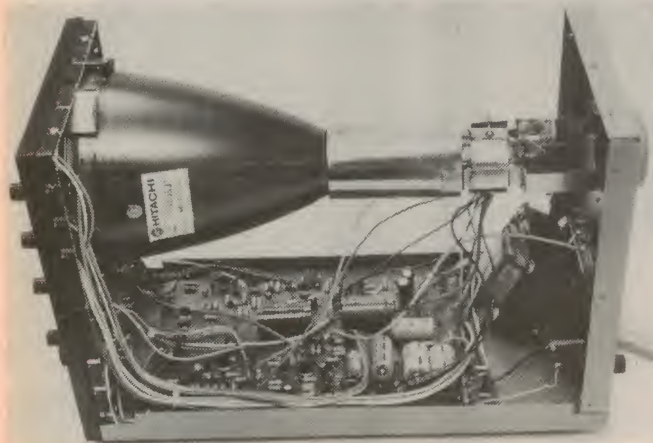
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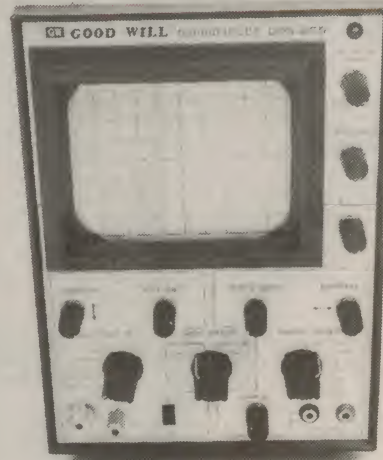
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A low-cost oscilloscope for the hobbyist

Most hobbyists and beginners want a CRO at some time but feel they can not afford it. Well the recently released "Goodwill" oscilloscope could be the answer. For just \$235 (including sales tax), the Model 955 features 10mV/div sensitivity, 6.5MHz bandwidth and four timebase ranges up to 100kHz.



LEFT: most of the components are mounted on a single PCB. Unit uses an Hitachi CRO tube.



An oscilloscope is the most versatile and powerful piece of test equipment a hobbyist can have, but for most hobbyists it is difficult to justify the cost of a \$600 plus CRO. However the Model 955 CRO from Good Will should be well within the means of most hobbyists, and while it does not have the features of more expensive CROs it is still a very useful instrument.

The 955 features a large 130mm blue phosphor CRT screen with an effective display area of 8 x 10cm. Overall dimensions of the unit are 250 x 180 x 415 (H x W x D) and weight is 4kg. Front panel controls include sweep range, vertical gain attenuator, vertical position and gain, horizontal position and gain and a variable sweep control. The various controls are well laid out and are grouped together according to function.

The vertical gain attenuator provides three attenuation steps, viz 1, 1/10, 1/100 as well as a .05Vp-p calibrate position and a ground position. The adjacent variable gain control provides a continuous x15 adjustment of gain for each range. Maximum allowable input voltage is 600V peak-to-peak while maximum input sensitivity was found to be 8.5mV/div, which is better than the quoted figure of 10mV/div.

Four ranges are provided for the timebase in x10 steps from 10Hz to 100kHz with a 100x variation in sweep speed available via the "sweep variation" knob. The maximum sweep speed is equivalent to 1μs/div which is quite a respectable figure for a low-cost CRO.

Additionally, the horizontal amplifier can be switched to external input for X-Y operation. In this mode we measured an input sensitivity of 250mV/div, which is the quoted figure.

X-Y mode is particularly useful for generating Lissajous figures and hence comparing the frequency and phase of two signals. For phase measurements to be correct, however, the phase shift in the vertical and horizontal stages should be the same. We found that there was very little phase error up to about 10kHz, beyond which the phase error increased up to 14° at 300kHz.

A rather unusual feature which has also been provided on the timebase switch is a "line" mode in which the horizontal amplifier is connected to a sine wave signal derived from the mains for Lissa-

jous figure generation.

Timebase triggering is selected by the "sync mode" switch which has four positions labelled int+, int-, line, ext. The first two modes enable triggering from the input signal, either on positive or negative peaks, while the line position obtains sync from the mains and the "ext" position switches sync input to the external sync inputs on the front panel.

According to the specifications the internal sync circuitry requires an input signal of at least one vertical division. This is essentially correct but there is no provision for syncing on more complex signals, eg, most CROs provide either a high pass or low pass filter and adjustment of the triggering level. The Model 955 lacks these features and we found that in some cases, either the vertical

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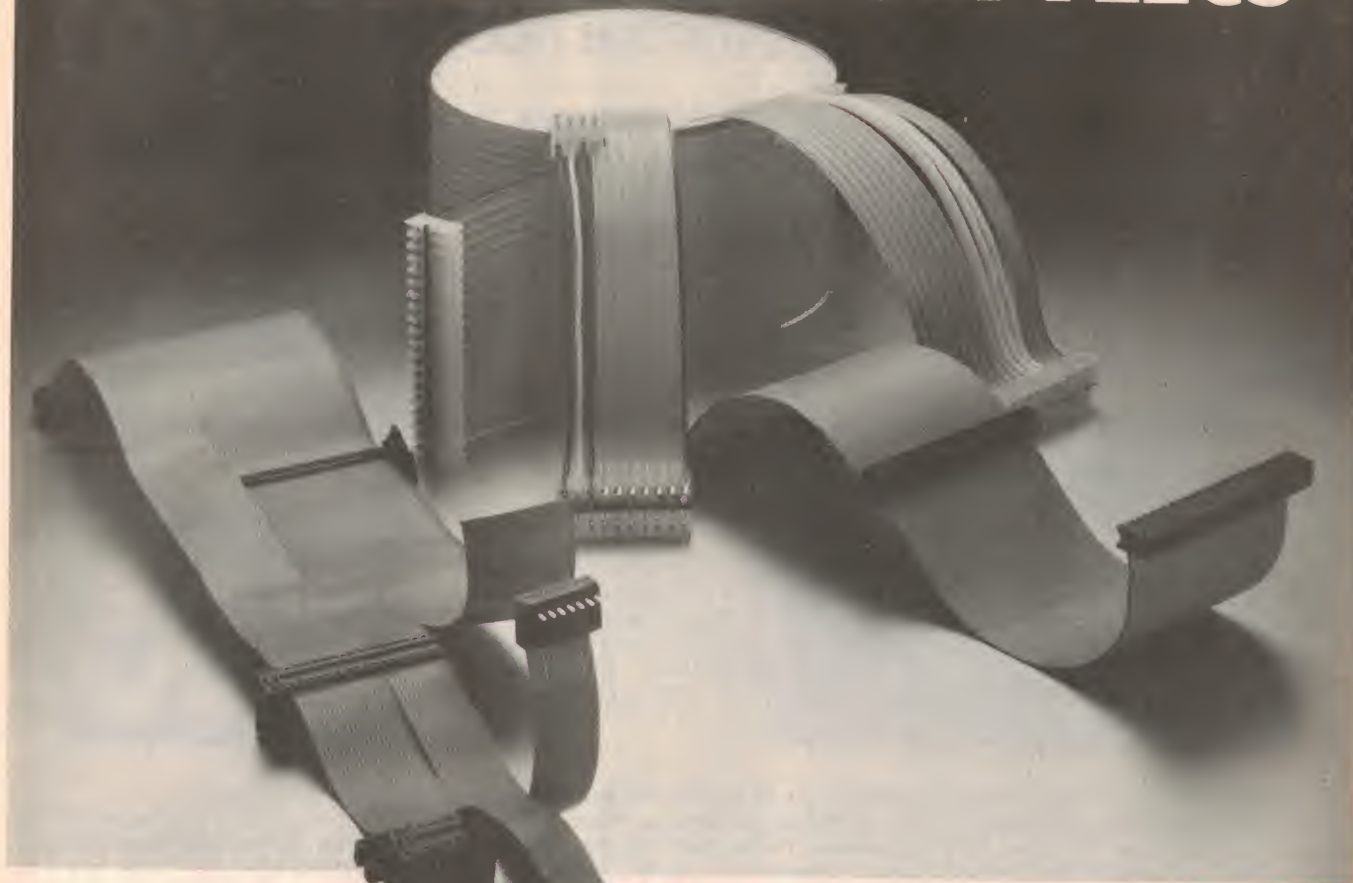
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The JF 156 (3.96mm) system has available 300 volt and 600 volt cable in 18 AWG and 22 AWG wire sizes. The family of cable connectors mate directly with the KK wafers which have been a proven industry standard over the past ten years. The JF 156 cable connectors have various options available. For example, non harness connectors for use with either ribbon cable or discrete wires, or, a mixture of both. Also available in this range is the new high pressure contact Trifurcon.

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New Products

(Continued from p119)

gain or variable sweep controls had to be adjusted to obtain a stable display.

We measured the input impedance of the CRO as 1M in parallel with 38pF which is close to the quoted figure of 1M in parallel with 35pF. It should be noted though that the cable supplied with the CRO has a capacitance of 90pF— not unusual in itself but most CRO probes have a x10 facility which reduces the overall probe capacitance to around 15pF. The input cable is terminated with a UHF plug and socket whereas most CROs use BNC sockets.

Bandwidth of the CRO is really very good at the price and we found it was somewhat in excess of the quoted figure of 6.5MHz. The horizontal amplifier bandwidth is in excess of 1MHz which is also better than the quoted figure of 500kHz.

Additional features include intensity and focus controls, AC/DC input switch, Z axis intensity modulation and mechanical trace rotation via screws at the back of the unit.

Internally the Model 955 is well laid out with most of the components mounted on a single-sided PC board which covers

almost the entire base of the unit. The CRO tube used is actually one manufactured by Hitachi and a small steel shield has been provided around the deflection area. The transformer incorporates a copper strap and has been mounted at a specific angle to help reduce the effect of hum fields.

In use, we found that the CRO display was bright and well focused, and the large screen size was an advantage though we did note that, at maximum gain and slow sweep speed a slight mains ripple was discernible in the trace— though this is unlikely to be a problem in most situations.

A 20-page user's manual is supplied and it includes operating instructions and a circuit diagram. A coaxial input cable is also supplied with a UHF connector at one end and alligator clips at the other.

There is little doubt that the Model 955 represents a good investment for the hobbyist. It offers a very good level of performance and at the low price of £235 it should be very popular.

Our review sample came from Radio Despatch Service, 869 George St, Sydney, 2000, phone (02) 211 0816 (R. de J.).

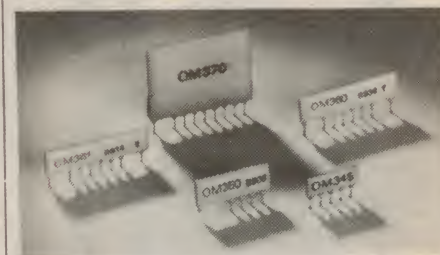
coupling and imposes minimal loading torque on the equipment being measured. It can be used to measure rotational speeds from 5 to 30,000rpm. The infrared tachometer has a range of 250 to 30,000rpm. Both instruments operate from internal dry cells, and rechargeable batteries and charger are also available.

For more information contact Tecnico Electronics, PO Box 50, Lane Cove, 2066; or PO Box 520, Clayton, Victoria, 3168.

High power rectifiers from Philips

Two new families of rectifier diodes, the PH40 and PH70, have been added to the Philips range of general purpose power devices. The rectifiers have average forward current ratings of 40A and 70A respectively, and both types can be supplied with peak reverse voltage ratings of 200V, 600V or 1000V. Both types are supplied in DO-5 packages.

Also available from Philips are two new 12V hybrid integrated circuit VHF/UHF wideband amplifiers, the OM345 and OM370. The OM345 is intended for use as an antenna amplifier in car radios and caravans, and has a transducer gain of 12dB and an output voltage of 99dB uV at 470MHz.



The OM370 is a three stage wideband amplifier with a transducer gain of 28dB and an output voltage of 114dB uV at 470MHz. It is intended for use as an amplifier in cable television networks and general VHF and UHF applications.

For further information contact Philips Electronic Components and Materials, 67 Mars Rd, Lane Cove, NSW 2066.

Hitachi CRO probes

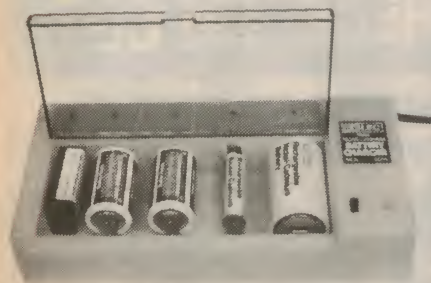
Standard Components Pty Ltd advise the availability of a new Hitachi Denshi probe suitable for their range of oscilloscopes.

The new probe, AT 100 AG 1.5, is a 100 to 1 and 10 to 1 switchable type usable up to 35MHz. Input impedance is 100MΩ on 100 to 1 and 10MΩ on 10 to 1 setting. The probe is rated at 100V DC +AC peak, and is fitted with a 1.5m cable and a BNC connector.

The AT 100 AC 1.5 is available from Hitachi oscilloscope stockist, Standard Components Pty Ltd, 10 Hill St, Leichhardt (PO Box 174), NSW 2040.

Versatile NiCd battery charger

A & R Electronics has recently introduced the PS519 Universal Nickel-Cadmium Battery Charger, which is being marketed under the Arlec brand. The design of the charger incorporates several new and very useful features.



The unit consists of a small rectangular cabinet measuring 21cm x 10cm x 5cm and weighing 300 grams. Charging power is derived from the mains through a pluggable adapter. The plastic cabinet has a hinged transparent lid covering the battery compartment, and the unit will accept a total five batteries— one 9V transistor radio battery plus four cylindrical 1.2V cells.

The positions provided for 1.2V cells have a fixed positive contact and an adjustable, spring-loaded negative contact

which allows batteries of different sizes to be accommodated. Four AA penlight cells, or four C size or D size batteries can be charged simultaneously, or batteries may be charged singly, in pairs, or in groups of mixed sizes.

Set into the plastic case above each battery position is a LED indicator lamp which glows when the battery it monitors is receiving a charge. The charger also includes a battery testing facility to enable the condition of batteries to be checked before and after charging. A two position switch on the top cover selects the Charge and Test functions, and test indication is by a LED which glows more or less brightly according to the state of charge of the battery.

Further details are available from A & R Electronics Pty Ltd, 30 Lexton Road, Box Hill, Victoria, 3128.

Digital tachometers from Tecnico

Tecnico Electronics have been appointed the Australian distributors for Tekel hand held digital tachometers. Two models are available, one a mechanical contact type for use where contact can be made with the device being measured, and the other a non-contact type using infrared detection to sense the rotating device.

The contact type tachometer uses frictional

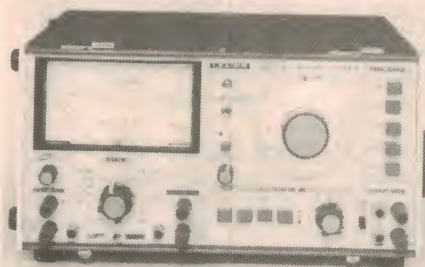
New Products

Leader audio test equipment from Vicom

Vicom International, the Australasian representatives of Leader Electronics Corporation of Japan, have recently released four new audio test instruments for the Australian market. The new instruments are a sweep/function generator, a log amplifier, an audio tester and a distortion meter.

The LFG-1300 is a multi-purpose function generator, designed to generate various waveforms over a frequency range of 0.002Hz to 2MHz. Outputs available include sine, triangle, square, pulse and sawtooth waveforms. Applications include testing and adjustment of equipment in areas such as medical science, physical geography and automatic control.

The new log amplifier, the LPA-1305, features a built-in detector, and is specially designed to be used with the



LFG-1300 sweep function generator. The LPA-1305 operates as a logarithmic amplifier for both DC and AC inputs, and three frequency markers are provided.

The LAV-191 audio tester combines a wide band audio generator, an audio attenuator and a wide range AC millivoltmeter. The audio generator section provides sine and square wave outputs into 600 ohms, and covers the frequencies between 10Hz and 1MHz in five switchable ranges. The attenuator section has a range from 0 to 120dB in 1dB steps, with an accuracy of $\pm 1.5\%$.

The AC millivoltmeter provides a voltage range of 1.5mV to 500V rms in 12 ranges, and a decibel range of -80dB to +56dB.

The last instrument in the new range is a distortion meter, the LDM-170. The instrument measures distortion, S/N (Signal to Noise) ratio and signal levels in audio circuits. Distortion products are fed to a high gain, wide band amplifier for display on an in-built meter.

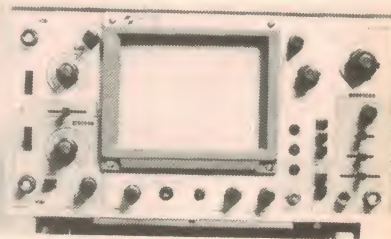
Contact Vicom International Pty Ltd, 68 Eastern Rd, South Melbourne, Vic 3205.

New range of oscilloscopes

GFS Electronic Imports of Victoria recently announced a new range of oscilloscopes to be released shortly. The new range of five models including one portable, is manufactured by Soar Corporation of Japan.

All models use rectangular cathode ray tubes with a built-in graticule which gives high resolution with a minimum of parallax error. All are dual-trace and are supplied with dual x1 and x10 probes. A trace rotation control on the front panel allows easy adjustment to compensate for variation in environmental magnetism.

The first model in the range is the MS-3015, a portable oscilloscope which features a 95mm CRT, sensitivity of 2mV/div over a frequency range of DC to 15MHz and add, subtract, chop and alternate trace modes as well as X-Y. Power supply may be 180 to 260V AC, 11 to 30V DC or an optional NiCd.



Top of the line is the Soar Model MS-6040, with a 150mm CRT and a 3dB bandwidth from DC to 40MHz. A trigger delay line is included allowing up to 120ns delays for close analysis of waveform rise times. Power requirement is 240V AC.

For further information contact GFS Electronic Imports, 15 McKeon Road, Mitcham, Victoria, 3132.

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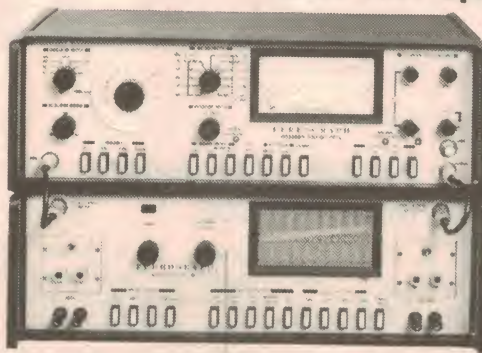
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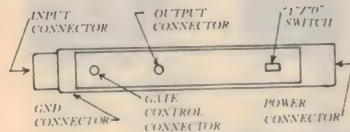
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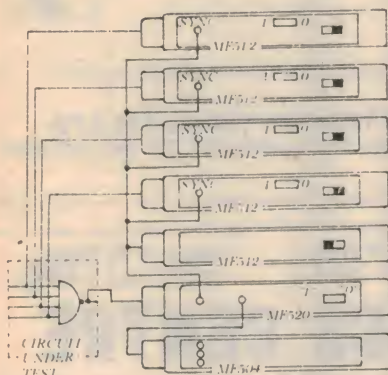
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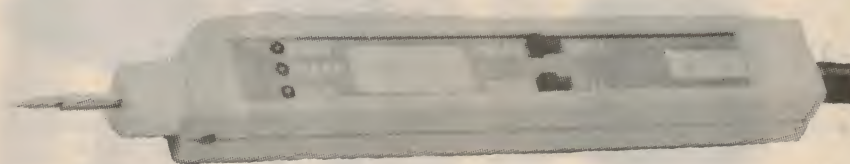
LOGIC SIGNAL GATE MF520

The Logic Signal gate MF520 is used to extend the operation range of the logic probes. Its main function is to open a small time window, and let the logic probe indicate a signal state in the window. A gate control signal is required to mark the beginning and ending of the time.



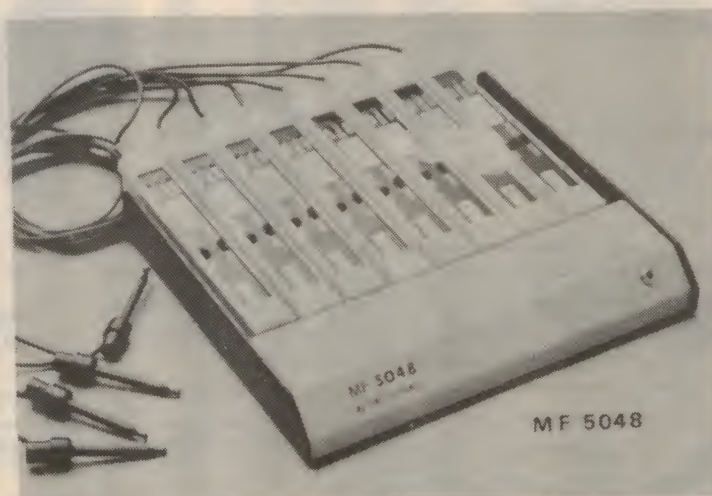
TRUTH TABLE TESTER MF5126

The tester is designed to test the truth table of combinational logic circuit on PC board, such as gates, decoders, multiplexers, arithmetic functions etc. It can isolate the circuit under test from other devices on the PC board. It comprises six model MF512 logic pulsers, one MF504 logic probe, and one MF520 logic signal gate. Logic pulsers are used to set input state of the circuit under test. Logic probe and logic signal gate are used to observe the output states of the circuit under test.



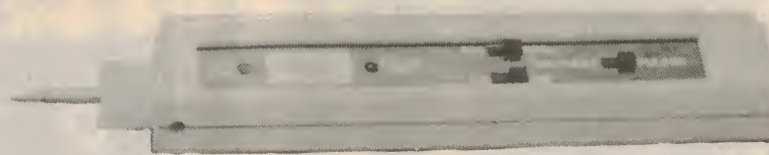
LOGIC PROBE MF504

The MF504 Logic Probe is designed for quick servicing and checking of integrated logic systems. With its unique multi-lamp readouts, the logic probe visually displays the presence of correct logic levels by illumination of coloured readouts. Incorrect logic levels are shown by the absence of coloured readouts.



8-BIT MONITOR MF5048

This instrument comprises eight MF504 logic probes and one MF420 probe rack. Mounting logic probe parallel on probe rack will ease viewing of the operations of counters, shift registers and data bus etc.



LOGIC PULSER MF512

A logic pulser is a valuable tool for trouble-shooting digital equipment. The use of a pulser to inject pulses into circuit nodes without cutting traces, removing ICs, on monitoring circuit response with a logic probe, is an effective method of locating faults in logic, connections, or components. The pulser produces high energy, short duration voltage pulses of a logic state opposite to that of the node under stimulation.

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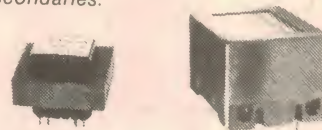
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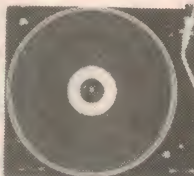
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New Products

BWD Instruments reorganises for the eighties



Mr Ron West, Marketing Manager of BWD Instruments Pty Ltd, demonstrates the 880 Powerscope to two prospective customers. The Powerscope enables measurements to be made of high voltage equipment safely and conveniently, and was a finalist in the recent Prince Philip design awards.

BWD Instruments Pty Ltd are in a strong position following re-organisation. By combining the design expertise built up over 25 years with a new and vigorous management team, the new company is confident that it can expand its share of the test equipment market, producing instruments of world class quality.

In 1979, BWD won a Design Award from the Australian Industrial Design Council for the BWD 880 Powerscope, designed by BWD's director and R&D manager John Beesley. To cope with the increasing

demand since the introduction of the Powerscope, BWD is expanding its production facilities at its Mulgrave factory.

Worldwide marketing activities are also being expanded. Both United States and Japanese distributors have expressed interest in handling BWD's products, and successful exhibitions have been held recently in West Germany, Ireland and Singapore.

For details of the Powerscope and other BWD oscilloscopes, contact BWD Instruments Pty Ltd, Miles Street, Mulgrave, Victoria 3170.

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Warburton Franki now has available three new families of Hexfets from International Rectifier. Designated the IRF510, IRF610 and IRF710, the new Hexfets are available with voltages ranging from 60 to 400V and current ratings from 1.3A to 4A at 25°C case temperature. They feature very low on resistance and freedom from secondary breakdown.

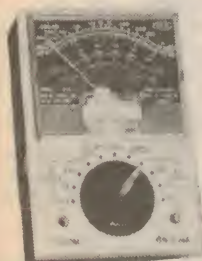
The 12 new types are packaged in the compact TO-220 plastic case. They said to be the fastest Hexfets available, with switching speeds of less than 10 nanoseconds with a standard 50 ohm load.

Typical application for the new devices include computer and computer peripheral designs, such as print hammer drivers. They are also suitable for stepper motor drivers, as used in computer disk drives, and for many applications in industrial control equipment and telecommunications.

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REVIEWS OF RECENT

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RAVEL/HAITINK: "A most endearing sensitivity"

RAVEL — Rapsodie Espagnole; Menuet Antique; Valses Nobles et Sentimentales; Alborado del Gracioso. Concertgebouw. Orchestra conducted by Bernard Haitink. Philips Stereo Cassette. 7300 573. Also available on stereo disc.

I have grown so used to associating Haitink with the heavy guns of music, Beethoven, Brahms, Mahler and so on, that I was surprised — though I shouldn't have been — to find him dealing so appreciatively with the ravier play of Ravel. On this cassette he covers a pretty wide spectrum of Ravel's slightly differing styles — he never changed very much — with the most endearing sensitivity.

Among the four pieces are the Valses Nobles at Sentimentales, a work that, while delighting me when played as well as it is here, has always been a puzzle. Which of the waltzes are sentimental and which noble? Not that it matters. They are varied enough to seem to run the gamut of every variation of the waltz form. Some Haitink takes at a strict 1, 2, 3 style; to others he gives the true swing of the Viennese type.

All are very elegant and all are helped by the very good cassette sound. This present generation of cassette recordings has reached a stage of excellence that I am often tempted to choose works in this form rather than on disc. They are so much more easily handled, less liable to damage and so convenient to store that my prophecy in The Sydney Sun many years ago — the first on the Philips system ever to appear in Australia — that they would eventually replace discs is not without some validity.

The next big work after the waltzes is the Rhapsodie Espagnole in which Haitink shows the same affectionate response to Ravel's subtleties, countless in this exquisite work in its four short, but beautifully contrasted movements.

After this comes the always contentious Alborado del Gracioso, so beloved of pianists for whom, like so many other Ravel works, it was originally composed and orchestrated later. Was Ravel being ironic or realistic?



The "gracioso" was, in Spain, a sort of court jester or a fop and here Ravel catches him purposefully making his way to serenade his beloved with a guitar accompanied song. There is a little stutter in this serenade that I think gives the game away and reveals Ravel's intention as ironic. And, after having finished his song, he leaves just as formally as he came. A very subtle joke indeed.

The cassette ends with a charming performance of the Menuet Antique — another little jest because the title is a contradiction in terms. There were no minuets in antiquity. (J.R.)

BRAHMS — Symphony No. 4 in E Minor. Zubin Mehta and the New York Philharmonic Orchestra. CBS Masterworks Cassette RC 6014. Also available on disc.

As a rule, Zubin Mehta can be relied upon to show some sign of exuberance but, in his reading of this work, it is sadly absent.

He almost strokes his way into the first subject of the first movement and then continues in strict time until things become decidedly monotonous. And this illustrates the emotional level of the whole disappointing performance. It is all strangely dead pan, a curious event coming from a man who can match passion with any other current conductor when in the mood.

The sound is good but everyone else associated with the production seems to be having an off day, perhaps the result of a too long recording session the night before. There are, of course, loud and soft passages but just loud and soft don't add up to eloquence or passion. And this is the New York Philharmonic, too.

Sorry but I cannot recommend it against its many better competitors. (J.R.)

JANET BAKER: "An enjoyable recital"

A JANET BAKER ALBUM — Songs by Handel, Purcell, J. S. Bach, Monteverdi, Berlioz, Ravel and Mahler. World Record Club Stereo Disc R 50308.

A new issue by Janet Baker is always a joy and this collection made between 1967 and 1972 gives us the opportunity to enjoy the many aspects of her great gifts.

Ravel's song suite Scheherazade is not generally regarded as first class Ravel although this is a point of view with which I differ. Asie is a wonderfully monothematic song rising to an ecstatic climax and scored with all Ravel's outstanding brilliance.

The least interesting item in the suite is possibly The Enchanted Flute but Ms Baker makes even this sound interesting.

And, to conclude, there is always the puzzle of the sex of the giver of an invitation to a passing stranger to stay the night.

The songs presented are by such disparate composers as Handel and Mahler and, although some of them are better suited to her superb timbre than others, all are well worth having. They've been taken from previous Baker recordings and cunningly chosen to present a vivid, enjoyable recital accompanied by many different instrumentalists and orchestras.

Although Ms Baker studied for some time in Paris, she has always had some little difficulty in acquiring the purity of French vowels, although hers never intrude tastelessly. Summing up, despite its very minor blemishes, I am completely appreciative of such a varied recital by one of the world's finest singers. (J.R.)

Reviews in this section are by Julian Russell (J.R.), Paul Frolich (P.F.), Neville Williams (N.W.), Leo Simpson (L.D.S.), Norman Marks (N.J.M.), Greg Swain (G.S.), and Danny Hooper (D.H.).

BRAHMS — Variations for piano on a theme by Handel. Three Intermezzi and Rhapsody, Op 119. CBS Masterworks Stereo Cassette, RC 6019. Also available on disc.

Here is playing in the grand manner. The massive Handel Variations are given a width and depth of conception, interspersed here and there with the lighter material introduced as a contrast by the composer. Some of the faster ones go at a speed that I cannot recall having heard before.

The whole work is fiendishly difficult and one of the supreme tests of a pianist's ability, both technical and interpretative. As a matter of fact, there is not much of Brahms' serious piano music that does not have hidden and often unique difficulties. Serkin's technical assurance will be the envy of anyone who has ever tried to play this piece. Contrasts are made without the slightest sign of a jolt. Serkin seems to have limitless sonorities under his control to change, at a moment's notice, from Chopin-like delicacy to the clangour of Beethoven's Hammerklavier — only more so!

The work finishes with a fugue with everywhere the weight placed in the right places; and every voice has its individual place in the whole. The piano tone couldn't be more faithfully reproduced.

The rest of the cassette is taken up with the four pieces of Opus 119. These are the intermezzos in B, E, and C and the E-Flat Rhapsodie. In the first Intermezzo he uses his Chopin fragile touch with every note under perfect control, however delicate. And, interpretatively, the piece acquires a nun-like serenity. No. 2 has unusual rhythms to start and, later these change to an enchanting second strain in which all Serkin's poetry seems to be compressed into a few ravishing bars.

His graceful treatment of No. 3 is a continuing delight. The concluding Rhapsody is better known than the other pieces in the opus. If it doesn't sound quite as abandoned as the word rhapsody is usually taken to mean, it makes a splendid end to a most impressive recital. (J.R.)

☆ ☆ ☆

ORFF — The Triumph of Aphrodite. Radio Chorus of Leipzig; Radio Chorus of Berlin with the Radio Symphony Orchestra of Leipzig conducted by Herbert Kegek. Isabella Nawa (soprano); Eberhard Buchner (tenor); Renate Krahmer (soprano); Karl-Heinz Stryczek (heavy baritone). Philips Stereo disc 9500 150.

Aphrodite is the third of a trio of works, the first of which, Carmina Burana, has won a wide audience all over the world. Aphrodite is in the form of an Epithalamium — a chorus sung outside a bridal chamber in Ancient Greece and a practice which survives in some Balkan countries today. Stravinsky's Les Noces is

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I think I should warn you: if you're a classical organ enthusiast and the owner of a normal home-style electronic instrument, listening to this Allen demonstration record will probably make you miserable. Oh for the money to buy such an organ and a disused stone church in which to install it!

Side one is tuitional in nature, of interest to any classical organ enthusiast and of potential use to music teachers in schools.

The narrator explains and demonstrates the difference between open flute and stopped flute pipes, the diapason and harmonically rich strings, clarinets of wood and metal, brass and reeds. He demonstrates the difference between baroque, romantic and modern voicing and the need to set up an organ to suit the acoustics of each building. All these most impressive sounds are produced by a large Allen electronic organ, in which the tonal structures are stored in the form of a string of digital numbers.

Side two carries excerpts from other Allen demonstration albums, selected to



show the use of the many classical voices available. Organists include Carlo Curley, Donald Westfield and George Thalben Ball. The selections: "Choral Prelude: Good Christian Men Rejoice" (J. S. Bach); "Adeste Fideles" (with Fountain St Church Choir); Rondeau "La Musecette"; "Intermezzo from the Widor Organ Symphony No. 6"; "The Elves" (Georges Bonnet); "Trumpet Tune" (Stanley).

The excerpts push the recording system (and maybe your cartridge) to its limits but the sound that comes through is as massive and as multi-voiced as you're likely to hear from all but the biggest traditional grand organs. And, of course, the artists are fully equal to the task of demonstrating the fact.

Which is why I warned you about having to address yourself to a (probably) less ambitious performance, on a less pretentious instrument, in a less accommodating acoustic environment.

But the ego-factor notwithstanding, this disc is worth \$4.60 of anyone's money who is interested in electronic organs. Write to the address above. (W.N.W.)



an example.

Especially good in this recording is the women's chorus, particularly in their quieter passages. They are followed early in the work by a sensitive duet between the bride and groom — a lyric interlude after the vigour of the first movement. Orff's unique style of rhythmic repetition is more subtly treated in Aphrodite than in his earlier works, obviously the work of maturity.

Then comes a soprano, hard under pressure in her high tessitura but thinning out as she goes along. There is a mellifluous ending to Side 1. All through the balance has been carefully observed.

The Second Side opens with a mixed chorus presented with great energy yet with plenty of colour in its many changes in dynamics and those Orffian rhythms.

In parlando a rather nasal bass warns the lovers of the passing of youth.

Like most Orff works the critic is aware that he is listening to something not quite out of the top drawer but it remains fine elemental drama. But what is important is that it definitely gets you in. It is not long before all resistance to it goes. The sound is first rate. (J.R.)

☆ ☆ ☆

STRAVINSKY — Petrouchka. (1947 version) played by the Concertgebouw Orchestra conducted by Sir Colin Davis. Philips Stereo Cassette 7300 653. Also available on stereo disc.

When Stravinsky composed Petrouchka back in 1911, he used a huge orchestra which included such unusual instruments as a sarrusophone and other exotica. This is the way I first heard it at the Alhambra Theatre in London just after World War I. Ansermet, who in those days favoured an ancient Assyrian-shaped beard, conducted. It was, of course in ballet form presented by Diaghileff.

Some years later the music became popular with sophisticated concert audiences but not practical with a band

RECORDS & TAPES — continued

that size. So Stravinsky rescored it for a band of more regular symphonic proportions and it is in that form that it is generally heard both at concert and ballet nowadays. It is the revised (1947) version that Davis plays on this cassette.

The sound is only slightly different from the original and such oddities as the sarussophone have been dropped — it is indeed a second revision made by the composer — the scoring remains a marvel of enterprise and imagination. And under Davis, with the eminent Concertgebouw, everything goes with a swing and brilliance that I found irresistible. The sound is good enough to make one wonder how so much detail could have been recorded on the narrow tracks.

The ballet seems to have dropped out of current repertoires — a pity because, in addition to the essentially Russian character of the music, the ballet itself is perhaps the most truly Russian of all Russian ballets.

The only niggling comment I can make on this superb production is that some of Davis' tempos vary from those used in the theatre and that dancers might find more than a little difficulty in executing the original choreography. But Davis handled the constantly changing rhythms like the master he is and the Concertgebouw is at its accurate and elegant best — alert perfect in ensemble both in attack and release and quite stunning in its enthusiasm.

Curiously the trumpet the girl dancer holds to her lips on stage sounds just a little off-stage. Otherwise the orchestral balance is superb, the solo piano part (originally conceived as a piano concerto) is splendidly enunciated with just the right amount of percussiveness to preserve unity with the orchestra. To me it is the most enjoyable of any performance of the work to date. (J.R.)

THE LEONINE CONSORT, BALMAIN COLLECTION. Cherry Pie CPF 1042. [PO Box 225, Pennant Hills, NSW 2121. Phone (02) 819 6151.]

It is a great joy to hear a group of unaccompanied voices with such evident skill and pleasure in what they are doing as The Leonine Consort in this Opera House recording. Under their director and founder, Charles Colman, they give us 17 delightful tracks of singing, ranging

from Bach to Monteverdi and William Byrd, with Thomas Ford and Thomas Morely in for good measure.

The content covers the gamut from Byrd's sacred music to the fairly uninhibited language of some of the early English Madrigals. There is also a Swingle type treatment of two Bach works, the 5th French suite for harpsichord and the Air from the Orchestral suite No. 3 in D.

I noted an occasional edginess to the sound quality but don't let this detract from the enjoyment the record can give. (N.J.M.)

Impressive organ record

Bach. Michael Murray playing the Great Organ at Methuen. Digital mastered stereo, Telarc DG-10049. [From PC Stereo, PO Box 272, Mt Gravatt, Qld 4122. Phone (07) 343 1612.]

As some may remember from an earlier review, the instrument used here was originally built by Walcker of Germany for the Boston Music Hall. It was later dismantled to obtain more stage space but was subsequently reinstalled privately in a special building at Methuen. Up-dates by Aerolian-Skinner and Andover have produced a magnificent recital instrument with four manuals, 84 stops, 115 ranks and more than 6000 pipes.

Gifted young American organist Michael Murray, who made his concert debut in 1972, presents this all-Bach program with complete assurance and fluency: Fantasia and Fugue in G Minor BWV 542 ("The Great"); Toccata in F Major, BWV 540; Passacaglia and Fugue in C Minor, BWV 582; Vater Unser in Himmelmreich, BWV 737; Alle Menschen Musen Sterben BWV 643. Total playing time is about 38 minutes.

Technically, the sound is superb and a further tribute to the instrument, the ar-

chitect of the Methuen auditorium and Telarc technology. Bass, treble and the definition on simple and complex passages alike, is all that one has come to expect of this label.

Whether the performance itself will please devotees of Bach organ music is another matter. For all his virtuosity and his success in concerts, on radio and on television, Michael Murray is seen by some as too much a reincarnation of his teacher and mentor Marcel Dupre, and lacking sensitivity to "the last 20 year's research into baroque keyboard performance practices".

That remark may be sufficient to discourage some but, for the most part, hifi enthusiasts will revel in the massive sounds from a beautifully voiced and well maintained traditional pipe instrument. (W.N.W.)



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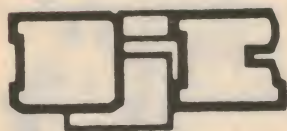
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RECORDS & TAPES — continued

THE DUTCH SWING COLLEGE BAND. Featuring Famous American Jazz Giants. Astor stereo FS341.

While the title of this disc may lead you to suspect that you are in for some real virtuoso performances, that is not what is in store. Just some polished renditions of old standards by well known American Jazz proponents, backed by the Dutch Swing College Band. If that appeals, then you will be satisfied. Recording quality is okay without being spectacular.

The "Famous American Jazz Giants" in question are Billy Butterfield, Teddy Wilson, Joe Venuti, Wild Bill Davison, Bud Freeman, and Jimmy Witherspoon. The tunes they play are: I Got A Right To Sing the Blues — Poor Butterfly — Wild Dog — Ole Man River — Exactly Like You — Dear Old Southland — Sweet Georgia Brown — Body And Soul — Three Little Words — St Louis Blues. (L.D.S.)

☆ ☆ ☆

TRUMPET AND ORGAN. VOLUME 2. Francis Hardy, Trumpet. Francis Chapelet, Organ. World Record Club stereo R 02213.

Strangely enough, there are no cover notes at all on this very pleasant record, apart from a brief remark to the effect that the recording was made in Studio 103 of the ORTF using an Erwin Muller organ. Enlightening, isn't it?

There is no clue as to the very competent string ensemble or who conducts them. Perhaps ignorance really is bliss, because I found the whole disc delightful. The organ is particularly well balanced against the string ensemble which can also be said of the trumpet. Recording quality is good.

PERIOD MUSIC — tee hee hee!

THE SIBYL'S GIGGLE. The Renaissance Players. Stereo, Cherry Pie CPF 1038. Also on cassette. [PO Box 225, Penant Hills, NSW 2120. Phone (02) 819 6151.]

The Renaissance Players as a group, and Winsome Evans as their moving spirit, are well known for their knowledge and expertise in the area of period music. But don't take this album too seriously; it is largely a send-up, made up from the lighter interludes which characterise their recitals.

Without the visual information, the listener to this album may be left in some doubt, at times, as to which is what. But, essentially, it is a fun album, intended to provide a "giggle" for the musically initiated. If in doubt, note that "Sibyl" on the frontispiece is winking; and, beneath her skirts, one can catch a

There are four selections from Johann Sebastian Bach, and one each from Torelli, Roberto Valentino, Cabezon and Albinoni.

The pieces are, from Bach: "Out of the Depths, I cry to Thee, O Lord", "Now Thank we all Our God", "Have Pity on me, Lord God" and "Lord Have Mercy, God the Father Eternal"; Albinoni: St Mark Concerto in A Major; Cabezon: Magnificat in the 4th Tone; Torelli: Concerto in D Major; Valentino: Sonata in D Minor (L.D.S.)

☆ ☆ ☆

MOZART. Clarinet Concerto in A Major, K.622 Concerto for Flute and Harp, K.2999. Jacques Lancelot (Clarinet), Jean-Pierre Rampal (Flute), Lily Laskine (Harp). The Jean-Francois Paillard Chamber Orchestra conducted by Paillard. World Record Clubs stereo R 03291.

Two well-known Mozart concertos are presented here and need little comment except to say that I found both performances enjoyable and quite on a par with other recordings I have of these works.

Recording quality was good although my sample disc did have some surface "prickle". Copious notes are provided on the record sleeve. (LDS).

☆ ☆ ☆

THE FILM MUSIC OF GEORGE DREYFUS Vol 2. The Melbourne Symphony Orchestra. World Record Club R08459.

Originally recorded by the ABC under the direction of the composer and David Measham, these themes from some of the more memorable ABC shows of recent years, may serve as a reminder



glimpse of one foot and one cloven hoof, unicorn style.

After that, what do the titles really matter? But I should mention "Matilda's Waltz (for Gough)". It turns out to be just what you think!

But, giggle or no, there are many sounds of period instruments, skilfully played. Alto solos are by Graham Pushee, who is in amazing voice without, I am assured, ever having submitted to a once traditional operation!

The sound quality is fine (W.N.W.)

to those who watch the box more than I do.

The seven tracks are: "Mary Gilmore Goes To Paraguay", a retracing of the New Australia movement's ill-fated attempt to found a Utopia in the 1890's; "Peace", a theme for a documentary on the original Anzacs; "Dimboola", written for the comedy farce about a wedding in a country town; "Rush", the well known music for the epic series about the lives of people during the hectic days of our first gold rush; "Symphony No. 2", written during Dreyfus' stay in Rome; "We Belong", written for the Ethnic TV service; finally the theme for the six part series; "Lawson's Mates".

The quality is excellent. (N.J.M.)

☆ ☆ ☆

TIME AFTER TIME. Original film score by Miklos Rozsa. The Royal Philharmonic Orchestra conducted by Miklos Rozsa. Digitally mastered stereo, Entracte ERS-6517. [From M. R. Acoustics, PO Box 165, Annerley, Qld 4103. Phone (07) 48 7598.]



Screen writer Nicholas Meyer certainly went overboard when writing the jacket notes for the album. They are devoted entirely to the subject of film music scoring and, in particular, to the work of Miklos Rozsa who scored such notable films as The Thief of Bagdad, Lost Weekend, Spellbound, Quo Vadis, Ben Hur, and so on.

Unfortunately, the only information about the film itself, "Time After Time", is a reprint of the credits and four not very meaningful stills. There is no synopsis and, if the prospective purchaser doesn't know the film, he is left to work out what it might be about by such track titles as: Search for the Ripper — The Time Machine — The Ripper; Pursuit — The Time Machine Waltz — Frightened — Murder — The Last Victim — Nocturnal Visitor — Dangerous Drive, etc.

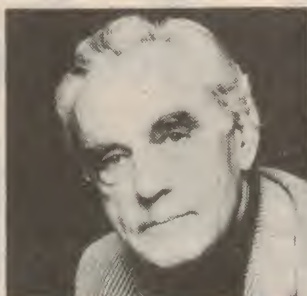
There are 17 tracks in all, scored for and played by a full orchestra, but they are necessarily thematic and of a nature and length dictated by the on-screen action. As a reminder of the film and a tribute to Miklos Rozsa, they have a role but I can't see too many getting excited about the album, as such.

In terms of quality, the recording itself is good but here another omission becomes apparent. If I had not checked M. R. Acoustic's price list, I might never

have known that the album came from a digital master. The recommended retail price, by the way, is \$12.00 (W.N.W.)

☆ ☆ ☆

GREAT BASS BALLADS. Allan Light. Stereo, Move MS-3029. (Move Records, Box 266, Carlton South, Vic 3053.)



A problem for any artist presenting a recital of traditional ballads is that his performance will be measured by the style established by big-name singers of the past.

On this basis, prominent Australian baritone, Alan Light's first number "The Boys Of The Old Brigade" "smacks more of the formal stage than of the reunion concert. On the other hand, his "Ma Curly Headed Baby" has a depth of feeling that loses nothing by comparison with Robeson, of other days. And his "Camp-town Races" is pure, rollicking fun.

All told, there are 14 tracks in this generous offering, the others being: The Cobbler's Song — The Stockriders Song — Down Among The Dead Men — The Lass Of Richmond Hill — Ten Green Bottles — Drinking — Men Of Harlech — The Land Of Who Knows Where — Greensleeves — A'roving — The Lincolnshire Poacher.

Recorded by the ABC, the album gives evidence of careful planning, with excellent support by the orchestra under Eric Gross and The Conservatorium Singers directed by Richard Gill. If you have an ear for these old ballads, you should enjoy this performance. The sound quality is excellent. (W.N.W.)

☆ ☆ ☆

ROGER FRAMPTON "IN VIEW". Stereo, Cherry Pie CPF 1039. [PO Box 225, Penrith Hills, NSW 2121. Phone (02) 819 6151.]

Roger Frampton explores quite a few styles of musical expression in this one-man concert, mainly recorded at the Sydney Opera House. Excepting for "The Girl From Ipanema", all eight tracks are from the artist's own pen. These are: December De Samba — Precious Air — Emily Jane — Tongue In Cheek — Between You And Me — Sober Variations — Music For An Un-Made Movie.

Most of the music would be best described as jazz in style, with the exception of the last track, which to my ears at least, did not make for pleasant listening.

Roger Frampton plays not only the piano parts but with the help of overdubbing, plays a wide range of recorders and saxophones plus the tuba. (N.J.M.)

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Column 80

by JAMIESON ROWE

Technical Director,
Dick Smith Electronics

Floppy disks & drives — your questions answered

This month, I'll try to answer some of the many questions I've been asked lately about mini-floppy disks and drives. Many people seem to find these devices rather puzzling when they meet them for the first time, and they're fast becoming a part of any serious microcomputer system. So if you're in need of a few answers, read on!

Q: What exactly is a mini-floppy disk, and how does it work?

A: A floppy disk is basically a magnetic record. The disk itself is about the same size as a 45rpm gramophone record, but instead of grooves it has a magnetic coating like recording tape. This lets a computer record or "save" either programs and data on the disk, from its memory. The recorded programs or data can then be played back or "loaded" back into memory, when desired.

Note that, unlike a 45rpm record, a floppy disk always remains in its protective sleeve. The sleeve is lined with lubricating film, so that the disk can rotate freely inside it. When the disk and sleeve are inserted in the drive unit, the disk is gripped in the centre by a collet-type "chuck", which rotates at 300rpm. The record/play head contacts the disk via a radial slot in the sleeve.

Q: I have seen reference to "hard sector" and "soft sector" disks. What do these terms mean?

A: Basically, programs and data are recorded on a floppy disk as blocks of binary numbers. The disk surface is regarded as consisting of a series of circular magnetic "tracks", and the data is recorded on each track in a series of "sectors", or fractions of a circle. In most cases, each track is divided into either 10 or 16 equal sectors, and each sector is used to store a fixed amount of data — usually 256 or 512 bytes.

Needless to say, the computer hooked up to the disk drive has to have some way of telling the rotary position of the disk at any instant, so that it can work out which sector is passing the record/play head. Broadly speaking, this position-feedback is done by using a photo-electric beam to sense one or more holes punched in the disk near the centre. But there are two different approaches.

The most common method uses a single hole punched in the disk. Fairly obviously this only gives the computer a

position-feedback pulse once every revolution, which means that the computer must work out where the individual sectors are by means of timing. As a program or "software" is used to perform the timing, and hence work out the sectors, this method has become known as "software" or "soft" sectoring.

In the other method, as well as the hole punched in the disk to mark the start of each revolution, there are additional holes corresponding to the various sector divisions. This method provides the computer with a feedback pulse at the start of each sector, so that it doesn't need to rely nearly as much on software timing. In other words, the sectors are defined by pulses produced by the "hardware" — hence the name "hard" sectoring.

Because the sectors are a little more tightly defined with the hard sector method, this approach tends to be favoured when disks are used for very high density recording.

Needless to say, the two methods need different types of disk — with a single hole for systems using soft sectoring, or with multiple holes for those using hard sectoring. The actual drives themselves are usually the same, however; it is basically the "controller" electronics which determines whether hard or soft sectoring is used.

Q: What are the differences between single density, double density and quad density drives?

A: Basically, as the name suggests the differences are in terms of the density with which information is recorded on the disks, and hence the total amount of information which can be stored.

The first mini-floppy drives used an FM (frequency modulation) recording system, and recorded data at the rate of 125,000 bits per second. This technique has become known as "single density" recording. As drives and disks were improved, it became possible to double the data recording rate to 250,000 bits per second, by using a modified-FM or "MFM" recording technique. Needless to say, this technique has become known as "double density" recording, and because it allows roughly double the information to be stored on the same disk, it is rapidly coming into favour.

The term "quad density" was coined by the Micropolis Corporation, in the USA. It is used to cover drives which not only

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use double density recording, but use narrower and more closely-spaced recording tracks, to provide a further increase in disk storage capacity. Instead of having tracks spaced at 48 to the inch, "quad density" drives tend to use a spacing of either 100 or 96 tracks per inch (tpi). More about this in the answer to the next question.

Q: What about the number of tracks on a disk? I've seen figures like 35 tracks, 40 tracks, 77 tracks, 80 tracks and so on.

A: The first mini-floppy drive, developed by the Shugart Corporation, used 35 tracks spaced at 48tpi. The tracks thus used a band on the disk only 18mm or so wide, a deliberate restriction designed to improve reliability and reduce the demands upon the disk in terms of freedom from coating faults.

When Micropolis came out with their "quad density" drives, they provided these with 77 tracks spaced at 100tpi — still using a conservative band only around 19.5mm wide on the disk surface.

Recently, as a result of improvements in the quality of disks, designers of single-density drives have been able to make a moderate increase in the width of the band on the disk surface used for tracks. Most such drives are now designed to lay 40 tracks at 48tpi, on a band about 22mm wide. One manufacturer, Micro Peripherals, Inc, has also used an extended band for a dual-density drive. This provides 80 tracks laid at 96 per

inch, covering a band a little over 21mm wide.

So at present, there are not only two different methods of recording, but four different standards in terms of the number of tracks. And not very many of these are compatible with one another, unfortunately. Luckily, most computer users only need to re-load data and programs saved on disks using their own drives, so this doesn't cause as much strife and confusion as you might think. Just as well, isn't it?

Q: What does all this mean when I go to buy the actual floppy disks? Are there umpteen different types?

A: If you're confused, don't worry — you're in good company! But no, the main thing to remember is that there are really only two different basic types of disk — hard and soft sector. Apart from this basic distinction, the only differences are in terms of quality.

When disks are made, they are generally burnished to give a very smooth and uniform surface over the area normally used for recording. Then they are tested for freedom from "dropouts" and other defects in the magnetic coating, which could upset recording. "Single density" disks are those which have passed the least stringent level of testing, and can thus be relied upon as being suitable for this use. "Double density" disks are those which have passed more exacting tests, and may be relied upon for double density

recording. "Quad density" or "Dual density certified for 77 tracks" disks are those which have passed double density testing over a wider area of the surface.

Needless to say, "dual density" and "quad density" disks tend to cost rather more than the basic "single density" grade. This is partly because you are paying for the additional testing, and partly because the yield is lower. Not all of the disks pass the more stringent testing.

Does this mean that you're forced to buy the more expensive disks, if you have dual density or quad density drives? Not necessarily. In most cases, the disks that are sold as "single density" have only been tested for this grade of performance — they haven't even been tested for the higher grading. In practice, a lot of them will give entirely satisfactory results in dual and quad density drives — particularly if they are made by a reputable manufacturer.

So if you don't mind checking them out for yourself, you can save quite a bit of money by using the lower cost disks. I do this myself, and although I use quad-density drives I've rarely struck a bad disk. The only real advantage of using the certified higher grade disks is that you can be assured that someone else has already tested them.

Well, that's about all we have space for this month, even though there are still quite a few basic questions to be answered. So I'll continue talking about disks next month — why not join me?

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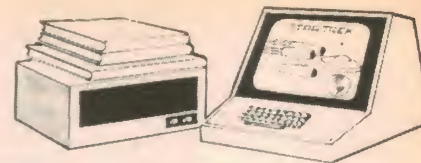
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Microcomputer News & Products



System 80 MkII Business Systems



Dick Smith Electronics has announced the release of a new System 80 MkII Business Computer, specifically designed for small to medium business computing applications.

The new machine is a development from the existing Model I System 80 computer, which has established itself as the fastest-selling micro-based computer in Australia (having sold more than 3000 units since April 1980). It provides virtually all of the features of the basic machine, together with many additional features designed to make it more suitable for serious business use. These features include full video display of lower-case letters (essential for word processing), and a separate numerical keypad for fast and easy entry of numbers.

The machine also features a built-in "communications terminal" program, making it ideal for accessing data base services.

The additional features of the Business Computer make it virtually three machines in one: a computer, a word processor (with suitable software), and a data communications terminal.

Like the original System 80, the MkII Business Computer provides the powerful industry-standard Microsoft "Level II" 12K BASIC as standard. This means that it can run just about all of the enormous range of software that has been written in this version of BASIC, including most of the software written for the Tandy TRS-80 machine.

As well as providing display of the full upper and lower case character set on its video screen, the new Business Computer provides lower case letters

with "true descenders" for maximum clarity. It also provides a choice of two different keyboard modes: "typewriter" mode (lower case letters normal, with the SHIFT key used for capitals) and "computer" mode (upper case letters normal). This makes it ideal for both word processing and normal computing.

In addition to the normal typewriter-format keyboard, the System 80 Business Computer provides a separate 15-key numeric keypad which lets you key in long strings of numbers rapidly with one hand and a minimum of effort. The numeric pad features backspace/erase, decimal point, comma and duplicate enter keys, quite separate from the main keyboard. In addition it provides four special "user-defined" keys which may be used to input special control codes or to call up certain functions.

In addition to its inbuilt communications terminal program, which can be called up at any time simply by keying in a couple of simple commands, The MkII Business Computer also has a facility to allow transfer of normal computer control to a second terminal or computer. So you can have one keyboard near the telephone and another near the sales counter, for example!

Other features of the System 80 Business Computer include an optional automatic flashing cursor and improved "anti-bounce" protection on the keyboard scanning for greater reliability.

Using a matching Expansion Unit, add-on memory card and various peripheral units such as printers, floppy disk drives and a modem, the machine can be expanded into a very powerful small

business system. It can have up to 48K of user RAM memory, up to four floppy disk drives with a total capacity of more than 400,000 characters, and a choice of either a matrix printer or a word processor-type daisywheel printer. An Australian-designed and manufactured acoustic coupling modem is also available, for data communications.

Dick Smith Electronics is supporting the System 80 MkII Business Computer with a range of Australian-developed software. Among the software currently available is a Stock Control and Pricing System, a General Ledger System, an Accounts Receivable System and a low cost Mini Word Processor for casual word processing. Further business software is being added to the range all the time.

Listed as catalog number X-4100, the new Dick Smith System 80 MkII Business Computer is priced at \$1495.00. The new machine will be available from Dick Smith branches and resellers in each state.

New CMOS μ P from Motorola Inc

A new eight-bit CMOS microprocessor, has been announced by the MOS Integrated Circuits Division of Motorola Inc.

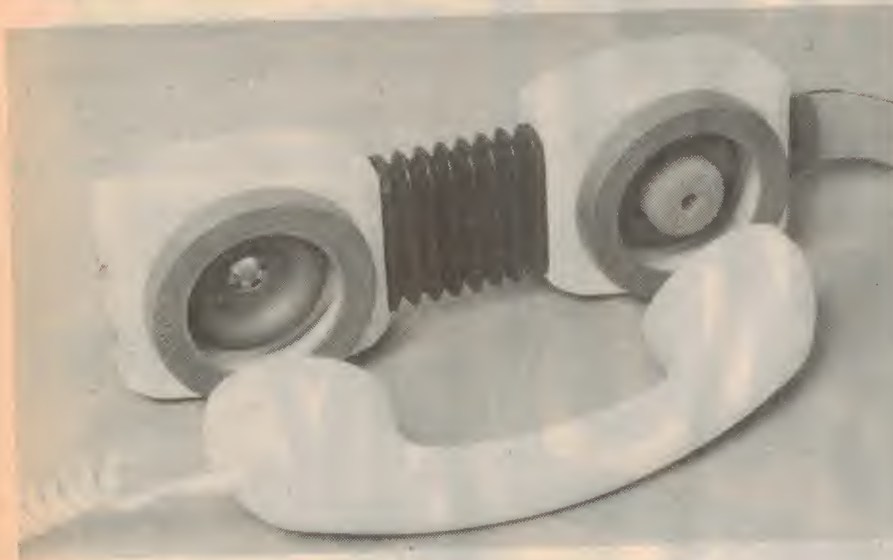
The processor, the MC146805E2, has 61 basic instructions similar to those of the popular MC6800 microprocessor, plus a complete set of bit-manipulation instructions to allow any bit in RAM or any I/O pin to be individually set or cleared with a single instruction.

The low power requirement, 20mW at 1MHz, and less than 1mW in standby, makes the device extremely attractive for those applications where power is a major consideration (portable instruments, telecommunications, point-of-sale terminals, appliance controllers, etc). The voltage range is three to six volts.

On-chip functions include an eight-bit timer with software programmable seven-bit prescaler, 112 bytes of RAM, and a clock generator. The multiplexed bus has an 8K byte addressing range. A companion 2K byte CMOS ROM, the MCM65516, is also available.

For further information contact Total Electronics in Melbourne, Sydney, Adelaide and Brisbane.

Low cost acoustic modem for small computers



Dick Smith Electronics has just announced a new low cost acoustic modem which allows digital data to be transmitted and received over the normal switched telephone network, at rates of up to 300 baud. The new device makes it possible for computers and data terminals to communicate using standard telephones, and for computer/terminal owners to access remote data bases.

Designed and manufactured in Australia, the new modem is compatible with most telephone handsets in use throughout the world. The transmitter and receiver of the telephone handset are simply fitted into the coupler's rubber-lined receptacles, after dialing up and establishing the required telephone connection.

Designated by the catalog number X-3270, the new modem features newly-

designed circuitry throughout, including a stable phase-coherent modulator, bandpass filters with carefully aligned and controlled phase characteristics, and a phase-locked loop decoder which incorporates active post detection filtering. In addition, special care has been taken with the design of the transducers, coupling cavities and seals.

The coupler is designed for full duplex operation, so that data may be transmitted and received simultaneously. It is also switchable between "Answer" and "Originate" mode, so that communication between two X-3270 units is just as easy as between one unit and a fixed "Answer" modem (when two duplex modems are communicating, one must be set for "Answer" mode, and the other for "Originate"). Power for the unit is normally provided by a standard 9V DC

"plug pack" supply, but provision is also made for supply from the computer/terminal.

The X-3270 is suitable for use with both the Exidy Sorcerer computer and the expanded Dick Smith System 80 computer. It is also suitable for virtually any other computer or terminal with a standard RS-232C serial data interface.

Price of the X-3270 is quoted as \$399.00. Further information from Dick Smith Electronics stores.

Adaptive Electronics moves house

Adaptive Electronics has announced that they are moving to larger and more centrally located premises at 418 St Kilda Rd, Melbourne. The move has been necessitated by the growth of the company's Cromemco Computer division and an expanding client base. The facilities at St Kilda Road include a larger showroom and offices, in addition to a well equipped service department.

Adaptive Electronics has been marketing Cromemco computer systems since 1978 and provides complete hardware and software support for the products. Cromemco computer systems range from small floppy disk systems to multi-tasking 22 Mbyte hard disk machines and support a large range of system software ranging through BASIC, FORTRAN, COBOL and an IBM compatible RPG II. In addition to Cromemco computers, AE's product range also includes Tandon and Persci floppy disk drives, IMI Winchester hard disk drives, ZS systems memory boards and the Adaptabox range of instrument cases.

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| Modules | \$39 (\$34.50) |
| Ti55 Calc | \$61 (\$54.50) |
| (If any Texas models are offered at a lower price — we will better it) | |

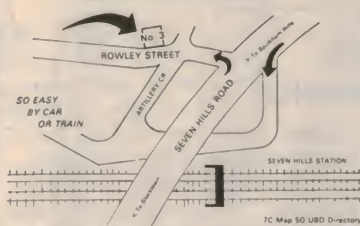
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Send S.A.E. for complete calculator and computer price list.

Pack and post — all LCD models \$1.50 anywhere in Australia (except Casio fx502p). Otherwise \$4.00 for registered post in NSW, \$5.50 elsewhere.



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PHONE 8.30am to 3.30pm
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A receipt will be issued immediately for all monies received.
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(Deliver next)

DISK DRIVE WITHOUT CONTROLLER

\$470 Tax Free \$540 Tax Paid

Our free software and hardware catalogue has our complete range and prices, all of which are substantially discounted.

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| 16k Apple II plus | \$1403 | Disk + Controller | \$725 |
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(For tax free prices divide by 1.15)
(Prices subject to change and exclude delivery)

Our range includes all Apple products and those of CCS and Mountain Computing.

- good and top quality monitors
- printers, Trendcom, Microline 80, Epson MX80, Paper Tiger, Anadex and Sanders
- the best in business, gaming and educational software
- card reader.

Microcomputer News & Products

Coinciding with the move, AE has announced the appointment of a new staff member. David Furst has joined the company as field service engineer and will also have responsibilities in the area of customer liaison and support.

Further information from Adaptive Electronics Pty Ltd, 418 St Kilda Road, Melbourne 3004. Telephone (03) 267 6800.

PET RTTY program from Edible Electronics

Edible Electronics has released new software which converts Commodore PET/CBM into an advanced amateur radio communications terminal. It features Baudot, Morse and ASCII send and receive operation, in addition to slow-scan television keyboard transmission capability.

Over 50 commands are recognised by the computer which gives a high degree of operating convenience and flexibility.

The program is written entirely in machine code and makes extensive use of machine code subroutines resident in the computer's ROM, making it fast in operation and easy to use.

Although an interface is not included, details of how interfacing may be achieved are included and should be within the capabilities of most amateurs.

The screen is split into three areas: one for received information, a command status line, and the data to be transmitted area.

The program offers the user the power of a dedicated terminal plus the flexibility of a fully programmable computer, so that full advantage can be made of the wide range of other programs which are available for the PET.

For full details contact Joel Gotlib VK3ZKE, Edible Electronics, 50 Park Street, Abbotsford, 3067. Telephone (03) 41 5708.

News from the clubs:

CAIRNS STATE HIGH SCHOOL has recently formed a computer club and is eager to set up a regular correspondence with other clubs. The address is Sheridan Street, Cairns, Qld, 4870 and the person to contact is Drew Barber, the club President.

THE SORCERER COMPUTER USERS of Australia (SCUA) wish to notify readers that they have changed their postal address. The new address is SCUA, PO Box 144, Doncaster, Vic, 3108.

THE WEST AUSTRALIAN Branch of SCUA wish to inform interested readers that they meet on the first and third Monday of each month. The meetings are held in the Computer Building at the West Australian Institute of Technology, Hayman Road, Bentley. For further information write to Secretary SCUA (WA), 90 King George Street, South Perth 6151, or phone (09) 367 6351.

THE NORTHERN AND WESTERN suburbs computer users group of

Melbourne held its inaugural meeting on February 5th.

The group, comprising 12 users of TRS-80 computers and a correspondent member in Brisbane, represents a considerable expertise in computer programming, especially in BASIC and assembly languages, as well as hardware adaptation. Operators of microcomputers and others interested are welcome to join the group and participate in an exchange of knowledge and mutual help in improving computing techniques.

Meetings will be held at 142 Pascoe Vale Road, Moonee Ponds, each second Thursday at 7pm. Those interested in joining the group may telephone David Coupe (03) 370 9590, or Clive Budd on (03) 370 2917.

A COMPUCOLOR/INTERCOLOR users group (CUWEST) has been formed in Western Australia. The group meets every month and has a software library available to members. Interested persons should contact J. D. Newman, 8 Hillcrest Drive, Darlington, WA 6070.

Computerland moves and expands its operations

Computerland Australia has announced that its Sydney franchise has moved to new, modern premises in the city centre. The new site is located on the Ground Floor of the St Martins Tower at 31 Market Street. The new store will offer the additional facilities of a computer tutorial station and a special area for business computers, in addition to the standard "hands on" computer demonstration areas.

Steve Mitchell the store manager, says "We'll be introducing new lines of computers to fulfil the expanding needs of our customers. Commodore, Cromemco and Zenith computers will add a new dimension to our sales".

Steve welcomes anyone interested in knowing more about small computers to visit the new store. The store will be open six days a week.

New 4051 desktop computer from Tektronix

Tektronix Australia recently announced a reconfiguration of its 4051 desktop graphics computer, which results in a significant reduction in price. The 4051 is the entry level computer of the popular 4050 series of which over 200 units have been installed in Australia.

In announcing the new 4051 configuration, Tektronix' National Sales Manager, Mr Peter Whitelaw, explained that the processor board has been redesigned to use the same memory chips as the 4052

(Continued on page 141)

FOR THE GOURMET



COMMODORE COMPUTERS

The range starts with the PET (illustrated) at under \$1,000 for personal use, through to complete business systems. We have a wide range of software covering Business, Education, Application and Entertainment.

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MOTOROLA KSN 1001A
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Prices include delivery



\$13.00 ea
\$25.00 ea

THIS MONTH'S SPECIAL

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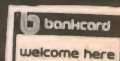
The ultimate computer programme for Amateur Radio Communications is now available for the PET.

Send and receive ASCII, BAUDOT at 45, 50, 75, 110 baud, and MORSE at 5 to 99 WPM. Transmit SSTV.

Written entirely in Machine Language, this fast and powerful program features a split screen with cursors and over 50 commands.

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CAN YOU AFFORD NOT TO SUBSCRIBE TO MICRO-80?

MICRO-80 is a monthly magazine dedicated to users of SYSTEM 80 and TRS-80 microcomputers. Owned and produced entirely in Australia, each issue of MICRO-80 contains at least six programs, articles, useful hints and answers to readers' problems; all designed to help YOU get the most out of your SYSTEM 80 or TRS-80. Since MICRO-80's first issue in December 1979, we have published over 80 major pieces of software and 10 hardware projects. Most of the programs and articles are written by our readers to whom we pay publication fees thus enabling them to make their hobby pay: MICRO-80 readers can save money by buying Tandy products at 10% discount from an authorised dealer — for details see any issue of MICRO-80. Our sister business, MICRO-80 PRODUCTS, sells Australian designed and produced software and high quality, imported goods at low, sensible prices. We repeat, if you own a SYSTEM 80 or TRS-80,

CAN YOU AFFORD NOT TO SUBSCRIBE TO MICRO-80? 12 month subscription delivered to your door, only \$25.00

CASSETTE EDITION only \$60.00 for 12 months

If you do not have enough time at the keyboard to type in the program listings which are published in MICRO-80 each month, then you need a cassette subscription. As well as MICRO-80 magazine, you receive a cassette each month containing all the programs listed in the magazine.

SPECIAL OFFER TO ALL NEW SUBSCRIBERS TO MICRO-80

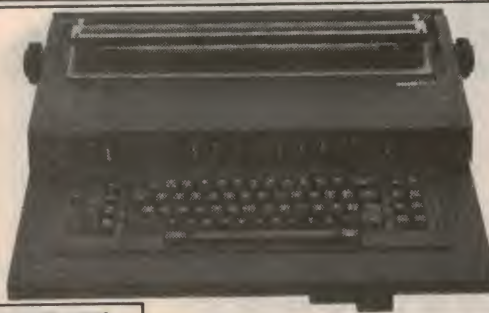
A FREE cassette containing 6 programs (3 Level I + 3 Level II), together with complete documentation, will be sent to every new subscriber to MICRO-80.

Suspicious of mail order? Then send \$2.50 for a single copy of MICRO-80 and see for yourself that this is the magazine for you!

Daisy Wheel Typewriter/Printer

MICRO-80 has converted the new OLIVETTI ET-121 DAISY WHEEL typewriter to work with the TRS-80 and SYSTEM 80 or any other microcomputer with a Centronics parallel port (RS 232 serial interface available shortly). The ET-121 typewriter is renowned for its high quality, fast speed (17 c.p.s.), quietness and reliability. MICRO-80 is renowned for its knowledge of the TRS-80/SYSTEM 80 and its sensible pricing policy. Together, we have produced a dual-purpose machine: an attractive, modern, correcting typewriter which doubles as a correspondence quality Daisy-wheel printer when used with your micro-computer.

How good is it? - This part of our advertisement was typeset using an ET-121 driven by a TRS-80. Write and ask for full details.



MPI DISK DRIVES

MPI is the second biggest manufacturer of mini floppy disk drives in the world. They produce a family of high quality 5 1/4" drives with super-fast track-to-track access times (5ms!)

40 TRACK SINGLE HEAD \$339
40 TRACK DUAL HEAD \$449
80 TRACK SINGLE HEAD \$499
80 TRACK DUAL HEAD \$599

Dual head drives use both sides of the disk and occupy two drive positions — it is like having two drives for little more than the price of one!

Prices quoted are for bare drives. Add \$10 per drive for a cabinet and \$30 per drive for a power supply.

DISKETTES FOR TRS-80

NASHUA 40 track single side . . . \$4.50 ea
VERBATIM 40 track double side. . \$5.90 ea
VERBATIM 77 track single side . . \$5.90 ea

THE FABULOUS NEWDOS 80 IN STOCK NOW!

ND-80 \$149

The disk operating system that gives:

- New basic commands that support variable record lengths up to 4095 bytes long.
- Mix or match disk drives — supports any number of tracks from 18 to 80. Use 35, 40 or 77 track 5" mini disk drives or 8" disk drives, or any combination.
- A security boot-up for basic or machine code programs. User never sees "Dos-ready" or "Ready" and cannot "break" clear screen or issue any direct basic statement including "List" and much, much more

77 TRACK DISK DRIVES DOUBLE YOUR CAPACITY

DD-7S \$775

Micropolis Floppy Disk, 77 Track, 100% larger capacity than most mini-floppy drives, complete with cable, power supply, chassis, and includes NEWDOS '80.

SYSPAND 80 FOR THE SYSTEM 80 \$119.00

SYSPAND 80 is a self-contained module which connects to the expansion port on your SYSTEM 80 and gives you a CENTRONICS parallel port to drive a printer PLUS the TRS-80 40 line bus. SYSPAND 80 allows you to connect all Tandy peripheral, including the expansion interface, disk drives, MICROTEK MT-32 memory expansion unit and the fabulous EXATRON STRINGY FLOPPY.

TRS-80 MEMORY EXPANSION UNIT MT-32 ... \$149.00

The MT-32 is manufactured by MICROTEK Inc., USA. It provides a CENTRONICS printer port and sockets for up to 32K of dynamic RAM. It comes complete, ready to plug into the expansion port of your Level II 16K machine. (Will also work with your SYSTEM 80 via SYSPAND 80).

MT-32A without RAM. \$149.00
MT-32B with 16K RAM. \$204.00
MT-32C with 32K RAM. \$249.00

16K MEMORY EXPANSION KIT

ONLY \$30 incl. p&p

These are prime, branded, 200 ns (yes, 200 ns!) chips. You will pay much more elsewhere for slow, 350 ns chips. Ours are guaranteed for 12 months. A pair of DIP shunts is also required to upgrade the CPU memory — these cost an additional \$4.00. All kits come complete with full, step-by-step instructions, no soldering is required. You don't have to be an electronic type to instal them.

DISK DRIVE HEAD CLEANING DISKETTES

\$29.00 plus \$1.20 p & p

Disk drives are expensive and so are diskettes. As with any magnetic recording device, a disk drive works better and lasts longer if the head is cleaned regularly. In the past, the problem has been, how do you clean the head without pulling the mechanism apart and running the risk of damaging delicate parts. 3M's have come to our rescue with SCOTCH BRAND, non-abrasive, head cleaning diskettes which thoroughly clean the head in seconds. The cleaning action is less abrasive than an ordinary diskette and no residue is left behind.

ONLY \$1995 INC. S.T.

To: MICRO-80

P.O. Box 213, Goodwood, S.A. 5034

Please rush me the items checked below:

- ☐ 12 month subscription to MICRO-80 and my free software cassette \$24.00
☐ 12 month subscription to MICRO-80 and the cassette edition, plus my free software cassette \$60.00
☐ The latest issue of MICRO-80 \$2.50

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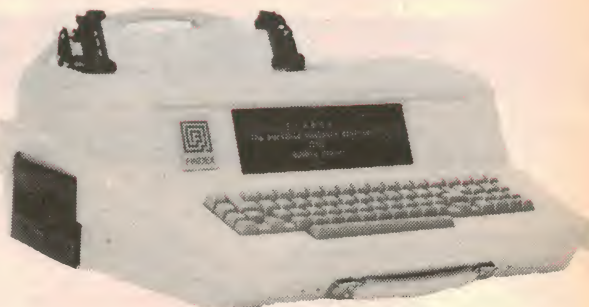
Suite 3, 454 St. Kilda Road, Melbourne, 3004. Telephone: (03) 26-5683, 26-6150.

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Powerful, multi-purpose microcomputer systems.

BUSINESS SYSTEMS

Priced competitively from as low as \$45.00 p.w. lease cost including sales tax and software.

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Debtors ledger and statements, creditors ledger and remittances, general ledger and trial balance, order entry/invoicing, sales analysis, payroll/wages, enquiry, word processing, mailing, record keeping, ledger card, doctors office, real estate, agency accounting, hotel/motel accounting, branch office accounting.

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BASIC SPECIFICATIONS

CPU 8080 and Z80 operating at 4MHZ. 64K bytes Dynamic RAM expandable to 2MB storage bytes of unformatted data on two double density drives. Optional external hard disk storage can be connected using the optional S-100 Bus. Floppy Disk. All modules mounted to base. CRT in a rigid aluminium frame. Disk Drive assemblies are mounted into special brackets for ease of servicing.

WINCHESTER DISK

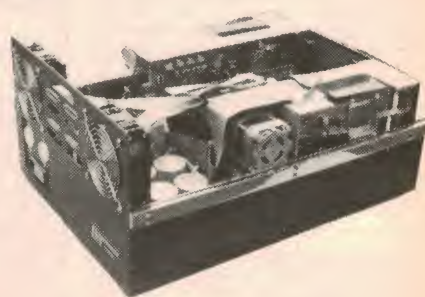
26MB of Winchester Disk complete with controller and easy backup. Disk has special capacity to only back up files accessed during the last period. Disk operating system CP/M.

OPTIONAL SOFTWARE

FORTRAN, COBOL, BASIC.

Application packages. Extensive software development tools are available from leading software vendors, including software for the following applications: payroll, accounts receivable, accounts payable, inventory control, general ledger and word processing.

Mensa computers provide a service network throughout Australia at major service centre locations to minimise response time to service calls. To ensure that equipment will operate at peak performance, engineers and technicians are trained to ensure the highest possible standard of service.



Microcomputer News & Products

and 4054 systems. The end product of this simple design, according to Mr Whitelaw is a lower cost which is being passed on to users.

The 4051 now has a standard minimum configuration, 16K bytes of memory as well as extended capabilities of matrix manipulation and binary data storage at a price of \$7048, effectively a 20% price reduction.

A variety of peripherals and an extensive software library is available to all 4050 series users.

For further information on the 4051 contact Tektronix Instruments Australia, 80 Waterloo Road, North Ryde, NSW 2113. Phone (02) 888 7066.

New printer from Epson has disposable printhead



The print head in the new Epson MX-80 printer, is disposable. Conservatively rated at a full 50 to 100 million characters, service is as simple as changing a ribbon cartridge. "In fact", says a spokesman for Warburton Franki, Epson's Australian distributor, "you just snap the head out, throw it away and snap in a new one. It is as easy as that".

The MX-80 provides this and many other features normally found in printers costing a lot more. The choice of 40, 80, 66 or 132 columns of printing is available in as many as four distinct print density modes, a total of 12 different combinations which can accommodate nearly any printing requirement. More than half of these use multi-strike and/or multi-pass techniques to generate "correspondence quality" printing.

This makes the Epson ideal for manuscripts, mailing labels, proposals and any other function where attractive, clean, clear, well-formed characters are required.

Other attractive features of the MX-80 are bidirectional printing — logical seeking of shortest lines — 80cps — 64 graphics characters — forms handling etc. At \$900 (discounts on quantity orders), Warburton Franki regard the

MX-80 as a fully loaded printer at a "bare bones" price.

Further information from Warburton Franki, Sydney (02) 648 1711 or Melbourne (03) 699 4999.

Computer equipment at US prices

A new computer company opening in Sydney this month will offer its own microcomputer products to Australians on the basis of standard US retail pricing. The company is Q.T. Systems (Australia), opening in 238 Clarence Street, Sydney, opposite the Town Hall.

The company is associated with Q.T. Systems Inc of the USA, a large microcomputer manufacturer in the US, and this direct connection will ensure fast delivery and up to date technical knowledge.

Q.T. Systems (Australia) will specialise in both hardware and software, offering a complete service to the microcomputer user.

The centre will cater particularly for S-100 users, offering a wide range of high quality IEEE-compatible S-100 boards, available as either bare boards or fully assembled and tested. There will also be a range of systems customised to suit commercial and industrial applications.

Other supplies stocked will include diskettes, ribbons and print wheels.

Q.T. Systems will also provide a fully equipped service and repair centre, staffed by a qualified engineer and will commission and test all products prior to delivery.

Acoustic couplers from Transdata



Transdata of the UK has appointed Datamatic as Australian distributor for their range of acoustic couplers.

Extensively used throughout Europe, Transdata acoustic couplers provide data communications through the public telephone network at data rates of up to three hundred baud.

Two versions are currently available: the 307A, which is an economical "originate only" coupler, and the 307, which has both answer and originate modes as well as a self-test capability. Both models feature specially designed

(Continued on page 142)

COMP-SOFT

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OHIO SCIENTIFIC COMPUTERS

THE WORLD'S SMALLEST PASCAL TYPE COMPILER.

Pascelf is a 4K 6502 compiler which is ideal for educational purposes and can generate ROMABLE code.

Only \$48.00

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MICROCOMPUTER SERVICES**

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Phone: (03) 428 5269

This ad was printed entirely on the NDK S-4000 wordprocessing printer using

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Spellbinder can operate the NDK fully proportionally with variable character widths, can print ***scripts or ***scripts with both underlines and wide characters. And it will print around 200 of them every second!

Spellbinder

will drive any precision printer such as Diablo, Qume, Spinterm, etc. And Spellbinder will operate on almost any CP/M-based microprocessor — Sorcerer, TRS80, System80, Apple (with 280 card), Vector Graphic, Superbrain, etc. Full mailing-list facilities, mail-merge, boilerplate, forms-handler, alpha and numeric sorting, multi-column printing, line-numbering, etc.

And the system that printed this ad does our accounts and keeps our books, types our letters (as well as our letterheads!), keeps mailing-lists, does stock control and even corrects our spelling mistakes! It costs around \$8500 all up. And that's the top of the range! Contact us for a full demonstration.

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Microcomputer News & Products

adjustable "cups" to provide the best possible signal to noise ratio. Transmitted carriers are crystal locked and active filters are employed for reliable data separation. Mark and space signals are separated by digital filters, keeping errors to a minimum.

For further information contact Datamatic P/L, 60-64 Dickson Street, Artarmon, NSW 2064, Telephone (02) 438 2699.

Sanders Graphic 7 Intelligent Terminal



The new Sanders Graphic 7 terminal system now available from Datamatic is a high performance, intelligent terminal graphics system. It displays sharp clear images which users can modify using a variety of input devices.

The dynamic visual presentation keeps pace with real time requirements making

it ideally suited to computer-aided design, simulation and training systems, air traffic control and a variety of other applications.

Connecting directly to any host computer through a standard I/O interface, the system features one-button initialisation and two operating modes, local and system. Internal firmware handles all operator-host interaction, and performs other tasks normally carried out by the host computer. Test and diagnostic routines for automatic Go/No-go tests are included.

The graphics control program stored in ROM eliminates the need to download programs from the host, or write special interrupt handler, refresh driver, or communications routines. The terminal's functions may be extended by downloading programs from the host. Control may then be passed back and forth between the Graphics control program and the downloaded program.

The basic Graphic 7 System comprises a terminal controller, 53cm CRT display, input devices such as a keyboard with function keys, Sanders Photopen, a trackball or joystick and a standard RS-232C interface. The RS-232C is ideal for timesharing networks and allows the system to be connected remotely or locally to any host.

An optional 16-bit high speed parallel interface is available for applications where data load and response times are critical. With either interface, multiple station configurations may be set up by merely connecting additional display indicators to the system.

For further information contact Datamatic P/L, 60-64 Dickson Ave, Artarmon, NSW 2064. Telephone (02) 438 2699.

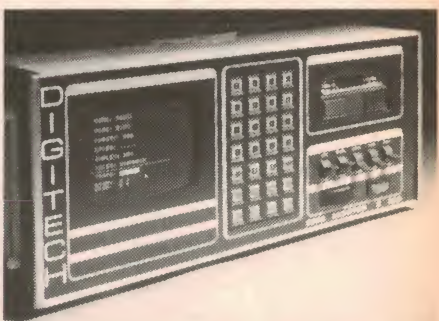
Data systems testing equipment from AWA

Amalgamated Wireless (Australasia) Limited, North Ryde Division, has been appointed Australian distributor for Digitech Data Industries. Digitech manufactures a range of instruments used extensively in the testing of data systems.

The range includes comparatively simple "Toolbox" portables, such as test sentence generators, bit error rate testers and digital distortion analysers through data transmission test sets and monitors to the top of the range - "Encore 100".



The Digitech Encore 100 is a diagnostic system enabling passive monitoring of data links or interactive simulation of system hardware and software components. The system combines a complete array of functional capabilities with an operating system that achieves the ultimate in its user-oriented program-mability and ease of use. It offers total diagnostic capability plus operating simplicity and programming flexibility.



Ease-of-use was the primary engineering goal in the development of Digitech's Pacer, which uses an advanced blend of hardware and software technologies to provide great versatility in data diagnostics. Pacer selectively monitors and displays all protocol, control and text characters and also detects and controls EIA lead status.

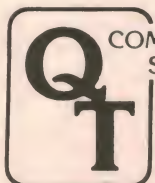
**Micronews
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Associated with QT Inc. - USA

THE AFFORDABLE HOME COMPUTER



When the System 80 was first introduced to Australia, the response was overwhelming! The Computer World was **ASTONISHED** at the **QUALITY**, as well as the **PRICE**. In fact, the System 80 has more features than the TRS-80, but with a price tag that is substantially less!

Microsoft's Level II BASIC and 16K Memory.

Another reason for all the commotion is that the System 80 uses the same, easy to learn, **LEVEL II BASIC** language that the TRS-80 uses! What does this mean? It means that the System 80 can run most of the 1000's of programs that have been written for the TRS-80 Level II, 16K computer! This means that you have scores of games, educational programs, business programs, simulations etc, that can be used with the System 80.

The System 80 is Expandable!

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Comparison Chart

| | Syst 80 | TRS-80 |
|--|---------|--------|
| CPU Type | Z-80 | Z-80 |
| Speed | 1.7MHz | 1.7MHz |
| S-100 Compatible (with expansion unit). | Yes | No |
| RAM (basic computer) | 16K | 16K |
| Built-in Cassette Recorder | Yes | No |
| Built-in Video RF Modulator | Yes | No |
| Capacity of BASIC ROM | 12K | 12K |
| Cassette Recorder Ports (basic machine). | 2 | 1 |
| Motor Control for Cassette Recorders. | Yes(2) | Yes(1) |

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MICROPROCESSORS & PERSONAL COMPUTERS

First printing 1980

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Microcomputer News & Products

Intel controls automotive engines

Intel Corporation, working with the Ford Motor Company's Electrical and Electronics Division, has developed a powerful new automotive engine control microcomputer system, the company announced recently.

The microcomputer system consists of only two integrated circuits; Intel's 8061 16-bit microcomputer and the 8361 read-only memory (ROM). The system is the "brain" of the EEC-IV electronic engine control system that Ford will use in production models in the mid-1980s.

Electronic engine control — using microcomputers to precisely set ignition timing and air/fuel ratios, for example — is one response of car makers to government and consumer pressures to increase fuel economy, reduce exhaust emissions and maintain or improve engine performance. Microcomputers can control engine functions more accurately than mechanical systems because they can make the very precise, high-speed calculations required to adjust fuel mixtures and spark timing to rapidly changing engine speed and load. The calculations often require 16-bit precision because the variables which determine the best fuel/air ratio (air volume/density, barometric pressure etc) can vary over a wide range.

The 8061 microcomputer was specifically designed for engine control applications, with a cycle time (time to fetch and decode one instruction) of just 200 nanoseconds. The 8061's program and the data which customises the system to a particular engine and drive train are stored in the 8361 ROM. The use of only two chips improves reliability and reduces costs, making the microcomputer suitable for use in mass produced vehicles.

Previous microprocessors designed for engine control applications required special chips to interface them to the manufacturer's chosen sensors and actuators. The 8061, in contrast, can be directly interfaced to a wide variety of sensors and actuators. The 8061 accepts analog inputs from sensors directly, in addition to digital inputs, and also provides pulsed digital outputs. The digital inputs are used to monitor rapidly changing events such as crankshaft movement. The high-speed digital outputs are suitable for pulsing spark plugs and controlling fuel injectors.

Intel Corporation is represented in Australia by AJF Systems & Components, 310 Queen St, Melbourne, 3000.

IBM to open Australian retail stores

Multinational computer giant IBM is expected to open its first Australian retail store for automated office products and its lower-end range of small computers within the next six months. A seven man task force appointed by IBM to investigate the feasibility of selling its products direct to the public through a retail outlet recently completed its report, and the team has recommended a location in Sydney for the store.

Mr Rob Carnahan, who has been appointed by IBM to carry out the recommendations of the taskforce, has stated "We have been investigating the possibility of a retail outlet for some time and the task force advised that it was financially feasible. They have even recommended a location within a certain perimeter in the heart of the Sydney shopping district."

The store would concentrate mostly on electronic office equipment but would also sell products from the general systems division of IBM Australia, such as the 51/10 and 51/20 range of small computers.

IBM has established about 20 retail stores throughout the United States and Europe, and in February 1981 opened its most recent store in Philadelphia. All of the stores have met with a good response from the business sector.

NOTE: Pacific Computer Weekly recently reported IBM's gross income for 1980 as \$26,213 million.

DATA 81

Data '81, Australia's largest annual exhibition of computers and associated technology is to be held at Sydney's Centrepont from August 25 to 27 and in

Melbourne at the Wentworth Hotel from November 10 to 12.

The exhibition and seminar series once again has the support of the Australian Computer Society and the Productivity Promotions Council of Australia. The organiser, Graphic Directions Pty Ltd, predicts that the event, now in its fifth year, will be bigger than ever.

National Promotions manager Jana Pearce says "DATA is now firmly established as Australia's premier computer showcase. Most computer companies regard DATA as a must event in their marketing calendars".

Intending exhibitors should contact Graphic Directions Pty Ltd, 28-36 Foveaux St, Surry Hills, NSW 2010, or 49 Cardigan Place, Albert Park, Vic 3206.

Micromation in the Schools

The Micromation computer system has been selected as the standard unit for use in Technical Schools in Victoria. A spokesman commenting on the decision said that the Micromation system was selected because of its modular design which allowed single user systems to be easily upgraded to multi-user systems as required.

The standard Micromation Z+ system is a single-user computer with 64K of RAM using a 4MHz Z80A microprocessor on a single S-100 compatible board. Multi-user systems can be developed simply by plugging in more boards at any stage. Each user is allocated an individual CPU and a 64K RAM bank, with no memory sharing between separate terminals.

Micromation systems are distributed in Australia by Microprocessor Applications Pty Ltd, Maskell's Hill Road, Selby, Vic 3160. A catalogue is available on request.

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INFORMATION CENTRE

CAPACITANCE METER: I have recently started to build your digital capacitance meter, but I have struck a few problems.

When I turned the meter on the LEDs lit up to form four zeros with decimal point and the trimpot adjustments have no effect at all on the readings.

I have changed the 74C926 plus the other IC to no avail. If you could help get this project going I would be obliged. (S. B., Palmerston, NZ.)

● The fact that you do have a full four digit display indicates that the 74C926 is probably working. Since it is not counting however we would assume that there is no clock signal or perhaps the latch and reset signals are at fault.

To determine whether the two oscillators IC1a and IC1d are working, connect a $0.1\mu\text{F}$ capacitor across on the input of the meter and using a CRO or capacitively-coupled AC voltmeter, check for an output signal from pins 2 and 8 of IC1.

If the oscillators are working then the 4017 or 4011 circuits could be faulty. When measuring, say, a $100\mu\text{F}$ capacitor on the μF range the clock should be sufficiently slow so that you can check the latch, reset and gate enable signals from the 4017 with a multimeter.

Having tracked the error down we would suggest that you carefully check wiring in that area and check for shorts or hairline cracks in the PC board.

ENGINE ANALYSER: I have just completed the Digital Engine Analyser project from your October 1980 issue. I have had difficulty in calibrating the device in the dwell and tacho modes. Following the instructions I adjusted the tachometer via VR1 in the 4-cylinder position to 1500rpm, fed from a half-wave rectifier circuit as shown in the magazine. The 6-cylinder position read 1120rpm and the 8 cylinder position 750rpm.

I then proceeded to calibrate the dwell mode by adjusting VR2 to obtain 90° in the 4-cylinder position; the 6-cylinder position read 67° and the 4-cylinder position read 45° . Finally I adjusted the voltage by adjusting VR3 to correspond to a 12 volt reading on a reliable multimeter.

I have found the variation only to occur in the 6-cylinder position in dwell or tacho mode. The proportion of variation seems to be identical for both modes. This project is my first attempt at a digital meter; as I find the magazine

description slightly bamboozling I would appreciate as much advice as possible. (T. M., Albury, NSW.)

● When the tacho is adjusted to read 1500rpm on the 4-cylinder position the display should read 1000 on the 6-cylinder position and 750 on 8 cylinders. Similarly on the dwell range the display should read 90° for 4 cylinders, 60° for 6 cylinders and 45° in the 8-cylinder position.

According to the information you have supplied it appears the unit works on the 4 and 8-cylinder positions but not the 6-cylinder position. Hence the problem is likely to be in the 4018 divider circuit or possibly the cylinder selector switch S2. Check the wiring to the switch for the 6-cylinder position and also check that there are no errors on the PC board, particularly around the 4018 IC.

Note also that there is an error on the PC board as published in Notes & Errata in the March 1982 issue. While probably not relevant to the fault in your unit, the error on the PC board concerns the $0.1\mu\text{F}$ capacitor connected to pin 7 of the 555. It should be connected to pin 6 of the 555, as shown correctly on the circuit diagram of the October 1980 article.

GUITAR SUSTAIN UNIT: I am a hobbyist who wishes to construct a "guitar sustain" unit. I have a copy of a suitable circuit but it poses a problem because the transistors used have different names such as ZTX108. To an Australian this proves troublesome as I have never seen such a title for a transistor or any semiconductor.

I am wondering whether you will have a chart or something which changes the English names of semiconductors to Australian or a similar circuit with Australian semiconductors. The semiconductors used are: BC415P, ZTX108, ZTX384W (all transistors), XC5053R - (LED), RPY58A - (LDR). (S. S., Murtoa, Vic.)

● Transistors prefixed with ZTX are manufactured by Ferranti; according to our data it may be possible to replace these with a BC549 although it is not quite equal to some of the specifications of these transistors. However, without seeing the circuit we would still expect the BC549 to perform satisfactorily. As far as the LED and LDR are concerned we suggest you try standard devices as available from most suppliers.

TRANSISTOR ASSISTED IGNITION: I built a Transistor Assisted Ignition system as described in December 1979 from a kit purchased from an agency of Dick Smith, but had no success with it. The problems were, very heavy ignition interference in the car radio and difficulty in starting with sluggish performance at low speeds.

I found that increasing the condenser associated with the points to $0.33\mu\text{F}$ cured the starting and sluggish performance problem, but the ignition interference still remained. Can you assist me in curing the problem? (L. O'D., Strathfield, NSW.)

● Ignition interference can be caused by many possible factors, such as poor earthing, insufficient bypassing, broken high-tension cables and incorrect power connection. It is on this last point that we wonder if you have connected the power to the Transistor Assisted Ignition from the same fuse as the radio, making the reception subject to the interference. Alternatively, check the earthing of the radio and TAI as well as the bypass capacitor to the radio.

TI-59: I have just read your article on the TI-59 in the November 1980 issue. I would like to point out a few things:

(1) The Dsz function cannot be used on Register 40; this is reserved for the indirect addressing function. (That is the reason that TI did not implement the Dsz function on every register.)

(2) In reference to the memory division section, I have completely decoded it: (This is for the TI-59)

| | |
|----------------------|-------|
| 959 Digit | Digit |
| 958 Digit | Digit |
| 957 Digit | Digit |
| 956 Digit | Digit |
| 955 Digit | Digit |
| Guard | Guard |
| 954 Digit | Digit |
| 953 952 | Digit |
| 952 *10 ⁻ | |

Sign code #
*Exponential form is 10^{-} (two digits) # Sign code:

0, 1: number positive index positive
2, 3: number negative index positive
4, 5: number positive index negative
6, 7: number negative index positive
8, 9: Error (no idea what this is)

The start address of the register is:
952 (452) -R*8

where R is the register No.
TI58

I have written down everything that is not in the instruction book, and it comes to about six pages!

After looking inside my TI-59, I can see the TNC 0598N ICs Mr Dance was talking about. I also noticed that in both "piggy-backed" ICs, the fifth pin down on the right-hand side has been cut off (the IC on the bottom still has its leg intact). This may be of no importance, but on the other hand it could be.

I hope I have cleared up (or made worse) the confusion. (J. P., Fern Tree, TAS.)

AUTOCHIME: Upon completing the "Autochime" (September 1979) I have noted a problem which may have happened to other readers who have built the kit. I quote from the text: "If the wires are shorted continuously, the unit should run through the complete repertoire of 24 tones". My kit works perfectly except that if the doorbell wires are shorted continuously the chime will just keep playing the same tune over and over again. (Until you un-short the wires.) Is this normal or could you suggest a reason and solution to this problem?

Just one more thing. Is the microprocessor used (MP0027 or CS107-01) interchangeable with the microprocessor used in, say, the Chroma-Chime and even others? (K. J., Semaphore, SA.)

● There could be several reasons for your problem. We presume that you have connected the bellpush to the front door "contacts" on the circuit board. If the bellpush were connected to the back door contacts then, by design, the Autochime would only play tune 21 ('Fate Knocking'). A similar effect occurs if diode D4 is shorted.

But if the one tune that you are hearing is other than "Fate Knocking", then the problem lies in the automatic switching circuitry. We would hope that you have installed the "link" between pin 1 of the 4024 and pin 1 of the 4016, as shown on both the PCB component diagram and the circuit schematic. If, as explained in our original article, this link is omitted the Autochime will play a particular tune over and over again. You will recall that the link was provided to enable the constructor to select a particular tune: link in, the Autochime sequences; link disconnected, one tune only.

If none of the above applies to your problem, it may be that the fault lies in the CMOS circuitry. We would suggest that you adopt a step-by-step process in localising a fault within the CMOS circuitry. Firstly check that the "Ro" positive output pulse is being applied to the pin 13 input of the 4016, each time the front bellpush is actuated. Then check that an inverted Ro pulse is reaching pin 1 of the 4024 ripple counter. If OK, check that the 4024's output pulse is being applied to pin 1 of the 4016, and so on. Following such a procedure should enable you to pinpoint the cause of your problem.

W-I-D-E S-T-E-R-E-O?

WIDE STEREO: Could you please tell us what exactly is the "WIDE" and "SPACE WIDE" on recent imports of stereo cassette-radio units. My ears seem to say that there is a treble boost fed particularly to one channel, and a phase change and/or echo effect put into both channels of the stereo unit. Is it possible to create a pseudo-stereo effect device for serious tape recording enthusiasts? I would imagine that fidelity of the original piece is altered, but could the costs in tape noise be minimised? (G. S. K., Kensington, NSW.)

● Our main encounter with this effect was in a Toshiba portable stereo cassette/receiver, reviewed about 12

The answer to your second query is yes. It was fully explained in our original article that the CS107-01, MP0027 dedicated microprocessor is not only the same as that used in the "Chroma-Chime", but is actually supplied by Chromatronics (the manufacturer of the Chroma-Chime) of the United Kingdom.

12-230V INVERTER: In Volume 40 No. 11 for February 1979, of Electronics Australia, an item was printed entitled 12-230V Inverter with Overload Protection, by I. M. Woodhead. I am very interested in this type of inverter for use with a set of storage batteries of 170 volts in order to eliminate the necessity for a transformer.

I have built a 3.5kVA 3 Ph. Delta connected alternator which is to be direct coupled to a 6x2 metre Savonius rotor. The rectified output from the alternator will be 170 volts. The inverter would need to have a capacity of about 3kVA at 240 volts AC 50Hz.

Could the switching end of this inverter be altered to do what I require? It would mean that each transistor would have to be capable of switching a maximum of 12.5 Amperes at 170 volts. (H. K., Gympie, Q.)

● From your letter it would appear that you are looking for the design of a 3kVA (3000VA) inverter capable of inverting 170VDC to 240VAC 50Hz. This is a very specialised requirement. Our February, 1979 inverter project was designed to operate from a 12VDC source and provide 300VA output — only 10% of the power output you are seeking. Thus there is no simple way in which the unit could be adapted to your purposes.

INFRARED REMOTE CONTROL: I have recently constructed the Infrared Remote Control described in your magazine in October 1979. I am pleased with the overall response of the receiver but I have a slight problem. To get the receiver to operate, the infrared LEDs must be placed just in front of the photodiode. As soon as any distance is placed between the transmitter and

months ago. The effect was certainly very apparent but, at the time, no circuit was available and we never did take time off to ascertain how it was achieved. However, our impression was that some treble from each channel was reversed in phase and fed to the opposite channel, perhaps accounting for the treble boost effect that you mention.

This is reinforced by our further impression that the idea worked well with clean sound but, with a poor quality signal, any distortion seemed to be exaggerated, as did any noise. In short, while the "Wide" option may make the sound from a single-unit portable cassette/radio more interesting, we would doubt its role in a normal, high quality stereo system.

receiver, the unit ceases to operate.

The photodiode I am using is one obtained in Auckland and has a lens built into it. Could you please give me an explanation for this occurrence. (R. L., Hamilton, NZ.)

● It is likely that the photodiode you have used is not suitable for the Infrared Remote Control. We would suggest that you use the BPW50 photodiode from Philips which supercedes the BPW34 we originally specified and has the added bonus of an integral infrared filter. These can be obtained from Radio Despatch Service, 869 George St, Sydney or any of the retailers advertising kits for our latest Infrared Remote Control in May, 1981.

TRANSISTOR ASSISTED IGNITION: I recently built a Dick Smith kit of your Transistor Assisted Ignition (TAI) system with PUT correctly wired and installed it into my 1957 Peugeot 203. The system appears to be working properly as hot starting was improved in my old oily engine and no missing or rough running was experienced.

However, my tachometer has ceased to operate correctly. With the TAI connected, a normal reading of about 3000rpm reads at about 600 with wide pointer jumping. When the Tacho was connected across the points, the reading was increased to about 1500rpm but still with the fluctuations.

The tacho is a 1965 Smiths Impulse tacho and removal of the TAI system returns the tacho operation to normal. You described the symptoms of tacho failure with CDI systems and to avoid this problem was one of the main reasons that I selected TAI in preference to CDI. (P. W., Duffy, ACT.)

● For proper operation of an impulse tachometer with TAI, the tacho input should be connected to the negative terminal of the coil; ie the terminal which normally connects to the points. Assuming that you have done this and the tacho still does not work properly, we can only guess that it is sensitive to the

RESISTORS

| | |
|--------------------|-----|
| 150 ohm, 5W | 20c |
| 10 ohm, 5W | 20c |
| 47 ohm, 5W | 20c |
| 12 ohm, 3W | 20c |
| 2.5 ohm, 3W | 20c |
| 33 ohm, 3W | 20c |
| 8 ohm, 10W | 25c |
| 4000 ohm, 10W | 25c |
| 100 ohm, 5W | 20c |
| 330 ohm, 10W | 25c |
| 220 ohm, 5W | 20c |
| 5 ohm, 5W | 20c |
| 220 ohm, 10W | 25c |
| 950 ohm, 3W | 20c |
| 115 ohm, 5W | 20c |
| 10 ohm, 20W | 20c |
| 1k ohm, 5W | 20c |
| 5000 ohm, 5W | 20c |
| 6.8k ohm, 3W | 20c |
| 3300 ohm, 10W | 25c |
| 6800 ohm, 10W | 25c |
| 1500 ohm DUAL, 21W | 50c |
| 50 ohm, 5W | 20c |
| 330 ohm, 5W | 20c |
| 1k ohm, 5W | 20c |
| 820 ohm, 5W | 20c |
| 12 ohm, 10W | 25c |
| 470 ohm, 7W | 20c |
| 4700 ohm, 4.5W | 20c |
| 5000 ohm, 10W | 25c |
| 8.2 ohm | 5W |
| 3.3k | 7W |
| 27 ohm | 5W |
| 10k | 7W |
| 2.5 ohm | 3W |

CAPACITORS

| | |
|-----------------|------------|
| 0.0039uF, 1500V | 20c ea. |
| 6N8, 1500V | 20c ea. |
| 0.0068uF, 1500V | 20c ea. |
| 1200PF, 400V | 10 for \$1 |
| 0.068uF, 400V | 5 for \$1 |
| 2200PF, 630V | 10 for \$1 |
| 0.47uF, 250V | 10 for \$1 |
| 0.10uF, 400V | 5 for \$1 |
| 0.082uF, 160V | 10 for \$1 |
| 26k, 250V | 10 for \$1 |
| 0.041uF, 400V | 10 for \$1 |
| 0.033uF, 250V | 5 for \$1 |
| 0.027uF, 100V | 20 for \$1 |
| 220uF, 10V | 10 for \$1 |
| 1uF, 350V | 10 for \$1 |
| 470uF, 40V | 5 for \$1 |
| 1000uF, 16V | 25c |
| 2.2uF, 200V | 10 for \$1 |
| 0.047uF, 1500V | 50c |
| 47uF, 25V | 4 for \$1 |
| 680uF, 40V | 50c |
| 22k, 100V | 20c |
| 330uF, 25V | 25c |
| 2.2uF, 200V | 30c |
| 470uF, 40V | 50c |
| 680uF, 35V | 50c |
| 0.015uF, 250V | 25c |
| 1uF, 100V | 25c |
| 1000uF, 16V | 50c |
| 220uF, 16V | 50c |
| 2000uF, 63V | \$1 |
| 0.47uF, 400V | 50c |
| 680k, 250V | 25c |
| 0.12, 250V | 25c |
| 15nF, 250V | 10c |
| 120k, 250V | 20c |
| 10uF, 315V | 25c |
| 0.056, 250V | 10c |
| 500 MFP 10 VOLT | 5 FOR \$1 |

Slide Pots

| | |
|----------------------------|-----------|
| 250K-50K | 3 for \$1 |
| Dual 500K | 3 for \$1 |
| 1 Meg | 3 for \$1 |
| 2 Meg | 3 for \$1 |
| Including Fancy Gold Knobs | |
| 25K dual | 2 for \$1 |

SPECIAL

| | |
|-----------------------------------|------|
| 100 mixed resistors, all useful | \$2. |
| 100 mixed capacitors, fresh stock | \$2. |

AUDIO LEADS

| | |
|-------------------|-----|
| 3.5m to 3.5m, 7ft | 75c |
| 3.5m to 6.5m, 7ft | 75c |
| 6.5, 7ft | 50c |

MICRO SWITCH

| | |
|-------------|---------|
| 5A, 250V AC | 75c ea. |
|-------------|---------|

TUNING CAPS

| | |
|--------------|---------|
| 2 and 3 gang | \$1 ea. |
| Min 2 gang | 50c |

FUSES

| | |
|----------------------------|------------|
| 0.5A, 2A, 3.25 | 10 for \$1 |
| In line fuse holders | 30c |
| RCA jack plugs and sockets | 40c pair |
| 1A, 10 for | \$1 |

L.E. CHAPMAN

122 PITT ROAD, NTH CURL CURL.
MAIL ORDERS: BOX 156, DEE WHY, NSW. 2099.
TELEPHONE 93-1848.

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| | |
|------------|------------|
| AD 161-162 | \$2.50 pr |
| BSC 901A | \$1.50 ea. |
| BC 548 | 10 for \$1 |
| AD 149 | \$3 pr |
| OC9554 | 50c |
| BD202N | 50c |
| BD135 | 50c |
| 2NC055 | \$1 |

ELECTROS

| | |
|----------------------------|------------|
| 470uF, 25V | 5 for \$1 |
| 400uF, 10V | 5 for \$1 |
| 47uF, 63V | 5 for \$1 |
| 350uF, 16V | 2 for \$1 |
| 27uF, 160V | 5 for \$1 |
| 25uF, 63V | 10 for \$1 |
| 22uF, 160V | 10 for \$1 |
| 47uF, 16V | 5 for \$1 |
| 47uF, 200V | 5 for \$1 |
| 220uF, 10V | 10 for \$1 |
| 68uF, 16V | 10 for \$1 |
| 100MFD, 350V chassis mount | \$1 |

- Telescopic aerials, \$1.50
- 6 inch ferrite rods, 75c
- Rainbow lead, 5 strand, 20c per metre
- Line output transformers, 600 ohm, to 15 ohm, 20 watts, \$5
- Line output transformers, 1200 to 3/ohm, 5 watt, \$1
- Power supply units, filtered, 240 to 20 volt, \$12

Power leads 240 volt, suit most tape recorders, radios, etc. \$1 each.

TV Stick Rectifiers 20SC, \$1.00.

Phillips Colour TV Convergence Boards, \$3 each.

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POTS ROTARY

| | |
|---|-----|
| 1/2 Meg | 30c |
| 1 Meg | 30c |
| 100K | 30c |
| 100K Switch | 50c |
| 50K Double Pole Switch | 50c |
| 7.500 | 30c |
| 10K Switch | 50c |
| 250K | 30c |
| 50K | 30c |
| 20K | 30c |
| 10K Min Pots | 25c |
| 50/Ohm | 50c |
| 1/2 or 1 Meg Switch | 50c |
| 1/2 1 meg dual Concentric tapped at 100K | \$1 |
| 2 meg ganged double pole switch | \$1 |
| 1.5 meg dual ganged | 50c |
| 2 meg ganged log | \$1 |
| 1 meg dual ganged | \$1 |
| 1/2 meg dual ganged LIN | 75c |
| 25K, 50K dual ganged Concentric double switch | \$1 |
| 200K single line | 30c |
| 20K wire wound | 75c |
| dual log 10K | 75c |
| 100K dual ganged linear pots | 75c |
| 10K sub min log pots | 50c |
| 250K ganged pots | 75c |
| 25K lin ganged pots | 75c |

HOR Drive 3021 transformers for colour TV \$2
TV Colour Convergence Units 11270 44 x 6 \$3

PILOT LIGHTS

| | |
|---------------------|---------------|
| Screw in 6.3V | 10 for \$1.50 |
| 24V | 10 for \$1.00 |
| Pilot light holders | \$1.50 |

- Car radio suppressors, 3 for \$1
- 3 position slide switch, 50c
- Toggle switches, 25c
- 2 position push button switch, 50c
- 6 position push button switch, \$1
- 4 position push button switch, 75c
- Transistor ear plugs & leads, 3 for \$1
- In-line fuse holders, 4 for \$1
- 4 pole 2 position rotary switches, 50c

Pick up Cartridges BSR universal type Ceramic Stereo \$5
Audio Technica AT6 diamond stylus stereo \$12

DIODES

| | |
|--------------------|--------------|
| OA 626 | 4 for \$1.00 |
| OA 662 | 4 for \$1.00 |
| EM 410C | 4 for \$1.00 |
| DS 150A | 50c |
| DSY 130YO | 50c |
| OA 636 | 50c |
| HR 15 | 50c |
| Diodes BYX 55, 300 | 30c |
| BY 188 | 30c |

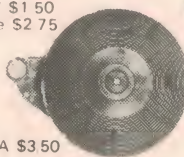
DIODES BAV20 10 for \$1

| | |
|---------------------|-----|
| Valve sockets 7 pin | 10c |
| Valve sockets 9 pin | 10c |
| OCTAL | 10c |

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|--------------------------------|--------|
| Mono | \$3 50 |
| Inc Ceramic Cartridge & Stylus | |

TRIMPOTS

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|---------|-----|
| 200 ohm | 10c |
| 5K | 10c |
| 100K | 10c |
| 47K | 10c |
| 10K | 10c |
| 470 ohm | 10c |

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Inc one 6 x 4 speaker, 5W RMS, \$4.75 ea.
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(For singles or pairs.)

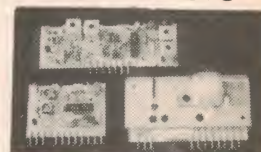
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| 15 ohm 4" — 2 for \$2. |
| 6x9 15 ohm \$5 each |
| 5x7 15 ohm \$4 each |
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| 6x4 15 ohm \$3 each |

5" 3.58 or 15 ohm \$3.50 each

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FM STEREO TUNER KITS



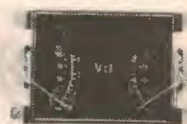
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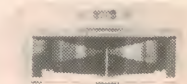
TRANSISTORS

| | |
|----------|------------|
| 2N3055 | \$1 20 |
| SE1002 | 4 for \$1 |
| BF459 | 50c |
| B544 DE6 | 50c |
| C106 F-1 | 50c |
| TIP 110 | 50c |
| 608EK | 4 for \$1 |
| BCS548 | 10 for \$1 |
| 2SB186 | 50c |
| 2SA101 | 50c |
| BD263 | 50c |
| BSR405 | 50c |
| 2SB77 | 50c |
| 2SB303 | 50c |
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12Kn 100uA \$2.00

PHILIPS TV TUNERS

Transistor NT3024, P&P \$1.



\$10 ea.

longer dwell angle of the TAI.

This can be readily checked by removing the 2N6027 PUT to disable the dwell extension feature. If the tachometer now works properly, it is sensitive to dwell. Although we haven't tried it, the circuit on p80 of our April issue could be the answer.

CAPACITOR DISCHARGE IGNITION: Having had utter failure with a CDI system in a VW Passat I decided to replace it with a Transistor Assisted unit which you also described in December 1980. This works very well, thank you. However, the cause of the failure of the CDI unit poses a question as to whether a fluctuating supply voltage from the alternator could cause misfiring. I was given this clue when I tested the CDI unit with a battery connected to a charger. The resulting miniature lightning display from the sports coil being used was only surpassed by the battery exploding in my face.

Indeed, both occurrences, although connected, were sources of great wonderment, especially my reaction time in closing my eyes in time to avoid a shower of battery acid. I note the warning in the article regarding battery chargers in your February 1981 issue.

I would appreciate your views on my hypothesis. (G.S., Yarralumla, ACT.)

● Well G.S., let us start by thanking you for your comments regarding the Transistor Assisted Ignition system. The exact problem with the CDI unit is almost impossible to pinpoint, mainly due to the lack of information in your letter. We can however say with confidence that normal operation of the CDI system is not affected by changes in the voltage of the car's electrical system. It is possible that the unit was not in fact misfiring. You mention that it was used with a sports coil. The output of a sports coil is potentially higher than a standard coil used with CDI and consequently, the possibility of crossfiring between the HT leads is much greater.

A point that has also been brought to our attention concerns the HT wiring in the Passat. It would appear that the HT leads are bunched together upon leaving the distributor cap. This coupled with the increased output of a sports coil can only serve to further increase the possibility of crossfiring. Fitting cable spreaders could go a long way towards resolving this problem, if it does not entirely banish it. However, your installation of Transistor-Assisted Ignition is the more complete answer.

Your other comments regarding the exploding battery do not surprise us. Any accumulator when being charged generates two gases; hydrogen and oxygen, both of which combine to form a very explosive gas mixture. The "lightning" display which you mention would have ignited this gas mixture causing the battery to explode. An article dealing with this subject at length appeared in the Serviceman column in May 1979.

NOISE CANCELLING — IS IT POSSIBLE?

NOISE CANCELLING: Some time ago I read about an English University (Liverpool?), where an electronic anti-noise device was being developed. The idea was to pick up the noise by microphone, analyse it, take the components with largest amplitude, phase-shift them through 180°, and after suitable amplification play them through speakers. Thus the phase shifted noise should cancel the original noise.

It occurred to me that a lot of people might be interested in such a device. Many people have neighbours who, at times, prefer decibels to fidelity or perhaps suffer from nearby industrial or traffic noises (this may apply especially in case of illness).

I would be interested to hear from you

if you know of such a device being on the market — alternatively may I suggest this as a candidate for a do-it-yourself kit. (P. H., Frankston, VIC.)

● Whatever the exact nature of the research at the aforesaid university, we would not be at all optimistic about it being able to satisfy the objective you have in mind. At best, it may be possible to achieve some cancellation at the lower frequencies in the immediate vicinity of a microphone/loudspeaker module. Elsewhere in the same room, at any significant distance from the module, signals from a single point source could not be expected to cancel noise impulses arriving from a variety of directions. If your problem is urgent, your best plan would be to move!

TELEVISION: Being a regular subscriber to your excellent magazine I thought I would take my turn to ask a few questions that have been on my mind. Firstly, how do they convert the American television system (525 lines) to the Australian TV system (625 lines to a frame) such that we can watch American programs without having either (1) 50 black lines on top and bottom of the screen or (2) a fuzzy picture? Have any previous articles been published about this?

Secondly I have been considering buying a logic solenoid controlled cassette deck, with all functions pushbutton-operated. I, like N.W. (Information Centre, August 1980), am interested in the possibility of a seven function remote control, and perhaps a remote on/off as well. Would you consider this as a future project?

Thirdly, still on the subject of cassette decks, I have found that all those logic decks containing frequency generator motors seem to allow the motor to run continuously whenever the deck is on. Why is this, and does it have a detrimental effect on the motor's life? Hence the desire for the remote on/off switch. (I.F., Edithvale, Vic.)

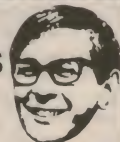
● While some stations perform a "standards conversion" by displaying the American program on an NTSC monitor, other stations have digital standards converters which do the job electronically. We featured an article entitled "DICE — Latest TV Standards converter" in the October 1977 issue.

We have no plans at present for a remote control unit as a project. One of the problems of such a project would be the varying switching methods used by different manufacturers in their cassette recorders. Many solenoid controlled cassette decks do not have provision for remote control, either wired or wireless.

We assume that by a "frequency generator" motor you mean a speed

control system using a frequency produced by the rotating motor shaft as feedback to a servo amplifier. Every motor system needs some time to come up to full speed, and this delay is eliminated by running the motor continuously while the unit is on. Continuous operation of the motor may shorten its life slightly, but any reputable manufacturer would use a motor designed for continuous operation, so this should not be a problem. ☺

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